Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, JULY 10, 1915 No. 2

The A. I. E. E. and Its Sections

ONE of the most important features of the affairs of the American Institute of Electrical Engineers is that concerning the relation of the various local sections to the parent body. Through force of circumstances the management of the affairs of the Institute has been centralized from the beginning. Many plans involving decentralization have been discussed from time to time but seemingly no better plan has been proposed than that now followed. Many of the defects that developed as the Institute grew in membership and influence were overcome by the establishment of local sections which have proved highly satisfactory for the purposes intended. That the dissatisfaction with the centralized management of the Institute, which came to the surface some years ago, has dwindled until it is now either non-existent or inappreciable was shown by the note of the section delegates at the Deer Park convention against the establishment of sectional vice-presidents. That the interests of the members in all sections of the country must be safeguarded is recognized by everyone, but the best method for obtaining this result can not be so readily defined. It is indeed gratifying to learn that in the A. I. E. E. as well as in the N. E. L. A. and other national organizations sectional differences are disappearing rapidly, the East and the West becoming more thoroughly in sympathy with one another as each becomes better acquainted with the other.

Public Testing of Meters

IT is a matter of gratification to the Rhode Island Public Utilities Commission and sufficiently noteworthy to receive comment in its last annual report, that "there has been little demand for testing meters. There have been only two requests for tests and in each case the meters proved correct." This, of course, is not a sign that service has reached total perfection or that human nature has ceased to grumble at public service companies. It is, however, a reasonably accurate indication that service is excellent and that enforcement of the service provisions of the law is not of first importance in the dealings of commissions with lighting utilities. When regulation was established three broad classes of questions required attention: Service, rates and financial. The electric central-station standard of service is high and, so far as properties of this class are concerned, commissions have been able to divert their main attention to rates and finances. If the sense of obligation to the public did not move electric central stations to render unsurpassed service the incentive to do so would be furnished by the highly commercialized character of their operations. Salesmanship is so large a factor in success that service cannot be left open to question in the permanent relation between producer and consumer. In their freedom from a burden of service matters affecting electric properties the commissions benefit from a condition for which they may be both thankful and outspoken in appreciation.

The Cost of Economy

THE offer of prizes by Mr. Frasse of Brooklyn for articles on economical uses of material suggests profitable study. Unless time is an element no economy is too insignificant for employees to make; but if time is involved, its mounting cost may be greater than the prospective saving. This is illustrated by the celebrated comparison of the old-fashioned office boy who untied packages carefully, saving both string and paper, and his twentieth century successor whose vigorous handling of knife or shears kept his time for something more important. The central-station industry has not reached the stage in its career when its wastefulness is attached; nor has it any desire to give any public notoriety seeker opportunity to pillory it. The inquiry started by Mr. Frasse will serve the fine purpose of pointing out specific economies; the application of them is a matter for individual or company decision. Every alert manager will decide at critical moments when true economy lies in a sheer disregard of cost that at other times would be reckless; as, for instance, when a service interruption threatens lose of revenue and customers' good will. Real art in management is revealed in such decisions.

The "Half Watt" Lamp and the Arc

IN the Digest this week will be found an important study of the much mooted question of the incandescent versus the arc lamp in street lighting. It is based directly upon recent German lighting practice and is particularly instructive because it deals specifically with enclosed flame arc lamps. All data are based on lower hemispherical candle-power when the lamps, arc and incandescent, are installed in suitable fixtures. On this basis, the German gas-filled lamp is credited with 0.5 watt per Hefner candle, which seems about the average figure to be expected. The flame arc, however, appears to show results somewhat higher than have been usually reported here, 0.2 to 0.3 watt per Hefner even for the inclosed type of lamp. Making all due allowances one expects considerably better efficiency from the flame arc than from the gas-filled lamp, but the results in cost from the data here considered are remarkable. They

confirm the position that we have steadily adhered to ever since the advent of gas-filled-lamps—that the best of the flame and luminous arcs can more than hold their own against the incandescent, but that the less efficient and the older types of arc must inevitably go. At equal light-giving efficiencies, the advantage probably will lie with the incandescent due to the absence of trimming and cleaning and to less trouble from outages and irregular performance. The greater steadiness in the light of the incandescent lamp is another strong point in its favor. One hears occasional talk of the "attractive sparkle" of the arc, but it must be regarded as a mere futile kicking against the pricks, for the open arc went down and out chiefly, so far as the public was concerned, on this very issue of unsteadiness. The whiter color possible with arcs may prove to be a psychological advantage of some moment, but the struggle for supremacy must be fought squarely upon the issue of efficiency, and on this the last word is far from being said.

Classification of Alternating-Current Motors

A rather interesting dissertation on the "Classification of Alternating-Current Motors" was presented by Mr. Val A. Fynn to the Deer Park convention of the American Institute of Electrical Engineers. In this paper some forty-four different varieties of alternating-current motors are classified, and the suggestion is made that there should somehow be nine more for a full list. However that may be, the list disclosed is long enough to surprise all but specialists in this line of electrical engineering development. The basis of analysis for the classification given in the paper is the separation of the magnetic flux in the machines into their components, and particularly into neutralizing and magnetizing components.

There can be no doubt that the customary nomenclature of the present day with regard to alternating-current motors is very defective and quite incapable of distinguishing adequately between the various types. On the other hand, it is doubtful whether the names proposed are suitable for industrial use, however well they may serve to distinguish between types. Perhaps some abbreviation can be made in these names without loss of discrimination. For example, the name proposed of "Inductively-Neutralized Single-Phase Series Motor, with Two Conductively Related Rotor Circuits" is surely better adapted to the needs of the next world than of this, wherein time and patience are limited. If, however, the principle of the classification laid down in the paper is agreed to, it may be possible to work out a practical list of fairly short titles in conformity therewith. The paper is likely to evoke an active and profitable discussion. Its tone is quite peaceful, except in the discussion of the term "repulsion motor," on which it makes open war. It must be confessed that this term is unfortunate, being neither distinctive nor significant. Moreover, it is a term that, like charity, may be made to cover a multitude of sins. Nevertheless, it is easier to criticise the term than to find a satisfactory substitute for it. It is about this term and its existing connotations that the discussion is likely to centralize itself most warmly. If agreement can be reached on this repulsive question, the rest of the field should be capable of a relatively easy settlement. It is to be hoped that the paper may be thoroughly discussed from all points of view in order to open a path to a general agreement. The A. I. E. E. standards committee has indicated in the last two editions of the Institute rules that no satisfactory alternating-current motor standards can be arrived at until the subject is cleared up.

Accounting for Small Properties

The introduction of an accounting system for small properties by the Southwestern Electrical & Gas Association is a move toward uniformity in that section. When it is borne in mind that out of 400 public utilities of different classes in Texas a large majority are properties of small or medium size, the necessity of a classification adapted to the needs and revenues of such plants is plain. In its report the accounting committee of the association considerately recommended that members use the standard system of their industry, as, for instance, of the National Electric Light Association in the case of electric utilities. This is wise, as it promotes standardization throughout the country. Because of its adoption by some of the state commissions and its use by many properties in various parts of the country, the classification of the national association has an advantage over all other systems. It represents experience and conference. In its action the Southwestern association committee fully recognizes the standing of the national association classification, but it offers also an abbreviation. Accounting of the Texas properties has not been subject to regulation by a state commission, so that it is probable that the methods in use vary greatly and fail to approach that carefulness in classification which is essential if the results in individual plants from year to year are to be comparable. Certainly the action of the Southwestern committee leads toward improvement, and whatever it can do later to encourage the use of the national system will accelerate the country-wide standardization which is so desirable.

The "Point Five" Tariff

As our readers will remember, there has been a movement among English municipal plants toward decrease of rates which has found its climax in the "Point Five" tariff, that is, 5/10 penny per kilowatt-hour as the secondary rate. At a recent convention of municipal engineers, some valuable data on the working of this scheme appeared, which are worth analyzing here. The tariff consists of a fixed charge, plus 1 cent per kilowatt-hour by meter for all electrical energy used. Generally speaking, the tariff is for residences only, and the fixed charge is made either on the basis of connected load or on the rateable value of the premises. This latter is very easily found from the assessor's

books, which in English practice take direct account of rental values, but it obviously is inequitable as in cases where large grounds add to the rateable value without increasing the electrical demand. Again, the use of electricity is by no means a linear function of the rental, so that the scheme really is based only on a rough average, and as actually worked out has to involve arbitrary modifications which make it really equivalent to an estimated connected load charge. Its only merit seems to be that it has an ostensible basis on official returns, and the actual sum charged varies from 10 to 15 per cent of the rateable value of the dwelling. A similar charge based on floor area or cubic contents would serve equally well, and the straight connected load charge is probably more nearly equitable than any of them.

Be this as it may, the results are interesting, but are not encouraging enough to justify the establishment of any such extraordinarily low rate in this country. The first effect of the system is to increase greatly the number of residence consumers, in some instances, doubling the number of services within a year or two. Beyond this, the very low meter rate greatly encourages the use of heating and cooking appliances. As regards the load, the new tariff in the case of two cities specially described quite doubled it, but in both cases the gross revenue from residences did not rise proportionally, so that the average price per unit was quite cut in half. As the usual English city plant is municipally owned, the "point five" tariff may perhaps not unjustly be regarded as a sop to the rate-payer. Nevertheless, there is a moral for the American station manager in the working of this cut-rate scheme. American conditions are not favorable for a cent a kilowatt-hour rate save with a preposterously high fixed charge; but the secret of getting profitable load is to give the average consumer a chance at a low secondary rate.

Municipal Electric Vehicles

At the recent convention of English municipal engineers, some important facts regarding the advantages of electric vehicles for municipal service were put upon record. For certain classes of service electric driving has peculiar advantages. For instance, in the collection of ashes and city refuse the electric truck has a great advantage over the gasoline-driven truck in that there is no waste such as that occasioned by keeping the engine working during stops, or from frequent stopping and starting. In Paris alone there are a hundred 5-ton trucks used for collecting refuse, and several English cities have already adopted similar vehicles. Considerable experience is accumulating in favor of electric drive for fire apparatus. Service of this sort in London shows a lower cost of maintenance and operation than with gasoline apparatus. Elsewhere similar results have been reached, and for city service electric vehicles seem to have altogether the advantage.

Incidentally, some striking figures as to the cost of operating electric vehicles were disclosed. In one instance, close watch had been kept on the expenses connected with an electric runabout with a nickel-iron battery. It was run an average of 24 miles per day in the service of the electricity works, and the running costs were found to be about 5.1 cents per mile, which with a somewhat large capital and depreciation charge of 6.4 cents per mile brought the total to 11.5 cents. A more liberal use would have probably lowered this to about 9 cents. Energy was charged in at 2 cents per kilowatt-hour. A comparison of bus service costs by gasoline, gasoline-electric and electric vehicles gives a fairer view of the possibilities. Here all three types were operated side by side under the same municipal management and the electric bus won out, at 15 cents per mile, including capital charges. The gasoline-electric and gasoline followed with 16.6 and 17.1 cents per mile respectively. Gradually, the electric vehicle seems to be coming into its own, and when charging stations become as plentiful as gasoline pumps it will.

The Milwaukee Street-Lighting Survey

Lack of uniformity in illumination of the street surface has generally been considered an evil inherent in our lamps and our methods of lighting which could not well be avoided. It was tolerated only as a necessary evil, and recent tendencies have been toward the perfection of lamps and accessories which will produce more uniform illumination. However, in Milwaukee the aim is to keep the light flux incident upon the street at a point nearer each lamp than would be required by the limitations of the reflecting and refracting apparatus. The reasons assigned for this by the engineers, as explained, are the importance of reducing the "blinding effect" in the eyes of street users and the alleged futility of the small amount of additional illumination which might be obtained midway between lamps were the light flux to be spread out to a greater extent. There is also the consideration that some day additional lamps midway between those proposed may be installed, and in such an event it would be desirable to confine the light flux as mentioned. Reducing the blinding effect by mounting the lamps as high as practicable has been advocated and practised for some time by illuminating engineers even before the recent quantitative investigation of blinding effect was made. No extensive attempt, however, has been made heretofore to reduce the candle-power of street lamps in the direction of the eye of the ordinary street user near the center of his field of vision, where the blinding effect is most pronounced. Whether a move in this direction is advisable, considering the fact that such a move necessarily carries with it, under the lamp spacings at present common in residence districts, a reduction of illuminations midway between lamps, is an open question which the engineers of the Milwaukee survey have answered in the affirmative. The practical results brought out by the trial installations which are now being made in accordance with these principles will be studied with much interest.

LETTERS TO THE EDITOR

Uniform Electric Rates Based on Costs

To the Editor of the ELECTRICAL WORLD:

SIR:—In your issue of June 26 Mr. William Adams of Lynn has a letter on uniform electric rates, based on cost, and, as is usually the case with those opposed to such rates, he goes to the extreme limit in his criticism, going just as far on the classification on one side, as the present system of rates is on the opposite. This is not at all just to those who wish rates based on cost. All they ask is that some reasonable arrangement of rates shall be made so that each classification of customer will pay a fair proportion of its cost. They do not wish to divide into minute classifications, but only such classifications as will give something approaching a just rate to all. As matters are at present, the small consumer not only pays his costs, but also pays the costs of the large consumer, and in some cases pays more than the costs. It is such treatment that the uniform electric rate advocates wish to see eliminated.

A Meter Expense of $6 per Customer

Mr. Adams states that the meter expense for a certain class of customers is in the neighborhood of $6 per meter. A statement like this is very easy to make, but it would be far more interesting if Mr. Adams would state what this meter expense consists of, or how it is made up. He goes on to state that it sometimes happens that a customer of this character uses only 10 kw. per year. This may be true, but unless I am greatly mistaken, there is a minimum charge against this customer of at least $9 per year, so that the company is well covered, getting approximately 40 per cent profit from the customer. What more can they ask?

If I understand correctly, meter expense represents the entire expense outside of the delivering of energy. If this be the case, a customer using this minimum amount would probably have a maximum demand in the neighborhood of 40 watts, or one-twenty-fifth of a kilowatt. At $6 a meter this would represent $150 per kilowatt. Taking into account the diversity factor—which in a case like this would be very large, as it has been demonstrated again and again that the diversity factor of a residence load is over four—this charge of $6 per meter would represent the interest charges on a cost of considerably over $600 per kilowatt of demand at the customer's plant. This figure is absurd for a plant of this character, and, therefore, represents a charge which is unjust.

Central Station Energy for the Third Avenue Line

He also takes up the case of the Third Avenue Railroad being served by the Edison company with energy. He assumes that the Railroad company was producing energy for 1 cent per kw.-hr., all charges included. This, however, does not represent a profit to the Railroad company. Its energy was produced for operating the cars, and it was the operation of the cars that produced the profit, not the generation of energy. The Edison company assumed this plant and delivered energy to the railroad. So far, so good, but who knows at what price the Edison company assumed the plant? Was it at full face value, or at a purely nominal figure? This would make an interesting investigation. If the figure was a fair one, the Edison company must make a profit on its investment, or else it is not treating its stockholders fairly. The profit on this investment should be the same as on any other portion of the investment, or the stockholders and the public are not being treated justly. Therefore the price paid by the Edison company is of vital importance; also the amount of profit which it is to obtain from the business. In addition, the cost of tying the two stations together must be considered as a part of the investment, and should be taken into account. This would increase the fixed charges on the plant as assumed and therefore increase the total costs.

The uniform rate-maker does not state that because the average costs of energy are 3 cents the Edison company should charge the Third Avenue Railroad 3 cents, nor does he ask that the Edison company should charge the residence customers 3 cents; but he does make this declaration—that the Third Avenue Railroad should pay the fixed costs on the investment required to furnish it with energy, plus the operating costs at the station and the operating costs in the actual distribution of the energy, plus all management charges, and states without equivocation and without fear of legitimate contradiction, that the fixed costs should be based upon the peak demand of the Third Avenue Railroad, because this peak demand comes at the same time as all other peaks of any moment on the system. This may be and frequently is denied, as it is said that the peak of such a system is very short. This so-called fact is not a fact. The peak of an electric railroad depends upon conditions at the time of the peak, and, as is well known, it may last for hours, particularly during a snow storm or a very heavy rain storm in the winter months, so that it is impossible to carry it successfully on the over-load capacity of the generators except at a decided reduction in the efficiency and strength of the unit, seriously impairing their value if the over-load is long continued. Therefore it is just that the railroad should pay the fixed charges on the peak-load investment, not only in the station but also wherever it may be necessary. It certainly should pay also the costs of operation and management during this period. This cannot be done at the rate now charged.

Therefore, in conclusion, let me say that the uniform electric rate advocates are as strongly opposed to the subdivision of rates to the extreme limit as are Mr. Adams or the advocates of the present system of rates. They are, however, equally opposed to the present system.

Boston, Mass. HENRY D. JACKSON.

Units of Brightness

To the Editor of the ELECTRICAL WORLD:

SIR:—Communications which have appeared in these columns during the past few months favoring the adoption of some unit for the expression of brightness (intrinsic brilliancy) in terms involving emitted or reflected flux per unit projected area, in distinction to candle-power per unit area as in previous practice, have indicated such a sentiment among those most interested as to bring about rather rapid progress in the introduction of new units. As a result two units seem to be well under way toward tentative authoritative adoption. One of these, very fittingly termed the "lambert," is the brightness of a projected area of 1 sq. cm emitting or reflecting 1 lumen in accordance with Lambert's cosine law; that is, emitting so as to appear equally bright when viewed from any direction. The other tentatively adopted unit is the foot-candle of brightness, which is the brightness of a similar surface emitting 1 lumen per square foot.

The writer has consistently maintained that the use is likely to create unnecessary confusion in the minds

of beginning students, and that, if used at all, this term should be preceded by the term "apparent," to avoid as far as possible this confusion. Even with such a modification an undesirable opportunity for confusion exists. For this reason the use of some such term as the "lambert," to be applied to brightness only, is very desirable. The term "foot-candle" is now commonly used for the expression of illumination upon a surface or incident flux of light. From its very nature brightness is emitted or reflected flux of light. Foot-candle brightness of a surface is sure to be confused by the beginner with the foot-candles of incident illumination. The least one can do to avoid this confusion is to use the term apparent foot-candle, but it is desirable to go even further than this.

This brings up the question: Why employ a unit equivalent to an apparent foot-candle of brightness at all, if the plain simple term "lambert" is available in accordance with the foregoing definition? This is a legitimate question, for which the following arguments can be advanced pro and con.

A Definition for the Lambert

The lambert as before defined equals approximately the brightness of a clear blue sky. This fact offers a popular standard of reference for explaining the unit to the layman. Being based on the metric system, the lambert is naturally preferable for purely scientific work.

A unit equaling the apparent foot-candle has the advantage of a direct relation to the foot-candle, which is universally employed in the United States and Great Britain, outside of a few scientific laboratories, for the expression of illumination or incident light flux. A still stronger argument in favor of a unit such as the foot-candle, however, is that if brightness be expressed in such units, there will seldom be use for more than one decimal point, whereas if brightness be expressed in lamberts there will frequently be need of six decimal points, and such values must be compared with others running well into the thousands to the left of the decimal point. The comparison of such ratios is confusing to the majority of people, and it is much better to keep the values to be dealt with as free from decimals as possible.

The writer recently offered a suggestion that the term "foot-lambert" be adopted as a substitute for the unit now called the "foot-candle" or "apparent foot-candle" of brightness.

Dr. Clayton H. Sharp has called attention to the advantages of the millilambert (0.001 lambert) as a practical unit for common use. This unit overcomes the practical objection of so many decimal points in ordinary work and fits in with the c.g.s. system. One millilambert equals 0.929 apparent foot-candles, a difference of only 7 per cent, so that for approximate mental comparisons between brightness and incident flux it is within the limits of easy comprehension and common instrument errors. The writer therefore favors the millilambert for common use in expressing brightness.

On account of lack of standardization of terms for expressing brightness, a number of such terms have been used to a limited extent, including those discussed above. In order to show the relation between these commonly used terms and to help in calculations, the writer has prepared the accompanying conversion table for units of brightness.

CONVERSION TABLE FOR VARIOUS BRIGHTNESS VALUES

Values Given in Units in This Column × Conversion Factor = Values in Units at Top of Column	Candles per Sq. Cm.	Candles per Sq. In.	Candles per Sq. M.	Candles per Sq. Ft.	Lamberts (Apparent Lumens per Sq. Cm.)	Ft.-Candles (Apparent Lumens per Sq. Ft.)	Milli-lamberts
Candles per sq. cm	1.00	6.451	10,000.00	929.03	3.14	2918.00	3141.6
Candles per sq. inch	0.155	1.00	1,550.00	144.00	0.4867	452.00	486.7
Candles per sq. meter	0.0001	0.0006451	1.00	0.0929	0.000314	0.2918	0.31416
Candles per sq. foot	0.00108	0.0069	10.70	1.00	0.0033912	3.14	3.3912
Lamberts (apparent lumens per sq. cm.)	0.318	2.054	3,180.00	295.8	1.00	929.03	1000.00
Foot-candles (apparent lumens per sq. ft.)	0.000343	0.00219	3.40	0.318	0.00108	1.00	1.076
Millilamberts	0.000318	0.002054	3.18	0.2958	0.001	0.929	1.00

JAMES R. CRAVATH,
Consulting Electrical and Illuminating Engineer.

Chicago, Ill.

Turbine and Impulse Wheels

To the Editor of the ELECTRICAL WORLD:

SIR:—In an editorial on page 1283 of your issue dated May 22, 1915, entitled "A High-Head Plant in New England," you state that "an exceptional feature of the plant resides in the use of regular turbines of the Francis type instead of impulse wheels. The head is such as would ordinarily be utilized through Pelton wheels on the Pacific Coast, where such heads are common, but impulse wheels at such heads are not so simple as at higher heads, requiring as they do multiple wheels and multiple nozzles for developing the 2000 hp demanded for each of the units of this plant." While the above statement might formerly have been applicable, it would hardly hold at the present time. The fact is that both the Francis-type turbine and the single-runner, single-nozzle Pelton type, each operating at its maximum efficiency for its type, are in use in a number of representative plants on the Pacific Coast where the head in question obtains, and the power output is as great as or greater than 2000 hp. The use of multiple nozzles for tangential wheels, except where high efficiency is not a desideratum, was discontinued many years ago, while the use of multiple runners is practically limited to two, one being overhung at each end of the generator shaft.

In support of the above remarks attention is called to the fact that there are three 7000-hp Francis turbine units, operating under 490-ft. head, at the Coleman plant of the Northern California Power Company, while at the South plant of the same company there is one 4000-kva generator driven by two 3000-hp overhung "Doble" tangential wheels, each having a single nozzle, under a head of about 500 ft. There are numerous other instances of both turbine and tangential wheels operating under from 450-ft. to 500-ft. heads, representing good practice and where high-service efficiency has been thoroughly demonstrated.

RUDOLPH W. VAN NORDEN,
San Francisco, Cal. *Consulting Engineer.*

Convention of A. I. E. E. at Deer Park, Md.—II

Classification of Electro-Magnetic Machinery, Street Lighting, Transformer Design and Rates Among Topics at Closing Sessions

In the issue of the Electrical World dated July 3 was published a report of the sessions of the convention of the American Institute of Electrical Engineers held at Deer Park, Md., on Tuesday, June 29. Below is given a report of the sessions of Wednesday morning and evening and of the concluding sessions on Thursday and Friday.

Classification of Alternating-Current Motors

In the paper entitled "Classification of Alternating-Current Motors" presented by Mr. Val A. Fynn, the author urged that the explanation of the operation of alternating-current motors and their classification be based on the component-field theory. To show how much more clearly motors can be identified by names based on this theory than on the resultant-field theory, the author classified about forty-four types of alternating-current motors and explained the operation of each. Accompanying each explanation was a schematic diagram of the motor connections intended to show the suitability of the classification proposed. It was further pointed out that there is no justification for using the term "repulsion motor" with any machines so far developed. If the term is not to be abandoned, Mr. Fynn insisted that it be rationally defined.

Classification of Dynamos

In the paper entitled "The Classification of Electromagnetic Machinery," by Mr. F. Creedy, a method was proposed for classifying all dynamo-electric machinery according to five characteristics: Type of field, method of disposing of power in secondary circuit, use of commutator, method of magnetization, and method of connecting circuits. It was pointed out that each of these characteristics may be sub-classified as indicated in the accompanying table. By using the letters representing each characteristic a dynamo might therefore be classified in a very simple and concise way; for instance, *C-A1-P-L-Se* would represent a direct-current series machine, and *V-A1-P-H-Se* a repulsion motor.

CHARACTERISTICS OF ELECTROMAGNETIC MACHINERY

Type of Field	Disposition of Secondary Power (A)	Commutator	Magnetization	Series or Shunt
Constant intensity (C)...	Zero (1)	None (N)		
Variable intensity (V)....	Wattless (2)	On primary (P)		
Multiple polarity (M)....	In cascade (3)	On secondary (S)	High-frequency (H)	Series (Se)
	Returned to line at primary frequency (4)		Low-frequency (L)	Shunt (Sh)

Discussion

The discussion was participated in by Messrs. C. A. Adams, Cambridge; A. S. McAllister, New York; H. M. Hobart, Boston; C. R. Underhill, New Haven, and V. A. Fynn, St. Louis.

Professor Adams explained that both papers had been prepared at the request of the standardization committee of the Institute in order to serve as a basis for determining the classification to be adopted by the committee.

Dr. McAllister called attention to the statement by Mr. Creedy that "an elliptic-field machine must necessarily have a commutator," and stated that the so-called single-phase induction motor is an elliptical-field machine. For this machine Mr. Creedy has provided no classification. He stated that the basis for Mr. Fynn's classification is absolutely fundamental and is the one least subject to confusion in interpretation.

Mr. Hobart claimed that Mr. Fynn's names are merely abbreviated definitions of the machine and are too long for practical use. He suggested the designation of the various types by the names of individuals identified with their invention or introduction.

Mr. Underhill stated that use could be made of the Taylor letter and numeral method in the designation of motor types, as is now done in designating types of electromagnets.

Introduction of Honorary Vice-President and President-Elect

At the opening of the session on Wednesday evening President Paul M. Lincoln formally introduced Prof. Harris J. Ryan of Leland Stanford, Jr., University, California, who is serving as honorary vice-president to represent the Institute during the Panama-Pacific International Exposition, San Francisco, and President-elect John J. Carty, New York.

In responding, Professor Ryan, who attended the convention not only as honorary vice-president but also as section delegate from San Francisco, called attention to the former isolation of the West from the East and said that the opening of the Panama Canal and inauguration of transcontinental telephone service have served to unite the West with the East and to make the problems of the one the problems of the other. And in the solution of these problems, continued the speaker, persons in both sections of the country are now equally interested.

Mr. Carty pointed to the excellent results accomplished in Institute affairs during the administration of President Lincoln who, he said, had displayed remarkable wisdom in the selection of members for the various committees to whom the work of the Institute is delegated. Harmonious co-operation has been in evidence on all sides. President Carty declared that the most striking feature of the electrical industry at the present time is its solidarity as proved by its stability during national business depression and international confusion.

To President Lincoln Mr. Farley Osgood presented on behalf of the whole Institute membership the past-president's badge as a token of appreciation of the excellent service rendered by him while in office.

Joint Session with I. E. S.

After the introduction of Honorary Vice-president Ryan and President-elect Carty, President Lincoln announced that the formal business session would be conducted under the joint auspices of the American Institute of Electrical Engineers and the Illuminating Engineering Society. He introduced President A. S. McAllister of the Illuminating Engineering Society, who then presided at the meeting. At this session Past-president Preston S. Millar of the Illuminating Engineering Society delivered an illustrated lecture on "The Effective Illumination of Streets," which was accompanied by a demonstration of good and bad street illumination by means of models of streets of different surfaces.

For purposes of analysis streets were divided into six classes. The author then pointed out that general appearance and the discernibility of surface irregularities and large objects are the results which should be aimed at in illuminating streets. Large objects become most discernible when there is a sharp contrast between them and the background, while small objects are most easily perceived by the shadows they cast. Too much emphasis should not be laid on the intensity of illumination, as this is not so important as the silhouette effect which will be produced. When streets are smooth and highly polished the surfaces between lamps appear almost as bright as those directly under the units owing to specular reflection. When it becomes recognized that street surfaces should produce specular reflection, important alterations will have to be made in some of the theories which have prevailed regarding street lighting.

In commenting on the location of lamps, Mr. Millar pointed out that the glare of light sources will be considerably less disagreeable if they are placed on the boundaries of the field of vision or if the contrast between the light sources and the rest of the field of vision is reduced. The latter condition will obtain if the streets produce specular reflection or if light-colored buildings face the street. To produce the right psychological effect, Mr. Millar advised increasing the brightness of street surfaces and surroundings and reducing the brightness of light sources moderately throughout the angles at which they are viewed.

The effectiveness of street illumination depends on the intensity of light on the street, brightness of the street surface, visual angle between lamps and street surface, extremes of contrast encountered, contrast produced on street surface and objects on the street, portion of total field of view illuminated, and the appearance of the installation by day and night. A table was given to point out that each one of these variables depends on four or more installation factors. Other data regarding several types of lamps now used showed that the candle-power of flame-arc and multiple gas-filled lamps depreciates 20 to 25 per cent throughout their life, whereas the candle-power of magnetite and series gas-filled lamps does not change appreciably.

In outlining present practice it was pointed out that high-intensity lamps are being used for street illumination, and cluster fixtures have yielded in favor of single or twin-lamp fixtures. Attention was called to the fact that specular reflection will be produced in a more favorable direction by placing high-intensity lamps over the center of a street than by mounting small illuminants at less height over the curbs. Another reason for using few high-intensity lamps, the author

DATA ON DIFFERENT CLASSES OF STREET-LIGHTING INSTALLATIONS

City and Street	Description of Street		Installation					Lamps	Accessories	Building Fronts Lighted?
	Width of Roadway in Feet	Kind of Buildings	No. of Lighting Units	Linear Spacing if Feet Along One Curb	Height, in Feet	Location	Kind of Mount			
Pittsburgh, Pa. Fifth Avenue	36	Business structures	50	Approx. 80	18	Both curbs—opposite	Brackets on trolley poles	6.6-amp. direct-current ornamental luminous arc	Medium alabaster globes	Yes
Pittsburgh, Pa. Federal Street	47		90	69	24	Both curbs—staggered	Ornamental posts	Alternating-current series flame, arc, white electrodes	Alba globes	
Chicago, Ill. Dearborn Street	42	Business structures	102	94	25	Both curbs—staggered	Ornamental posts	Alternating-current series flame arc lamps	Alba globes	Yes
Rochester, N. Y. Main Street	80	Business structures	222	100	14½	Both curbs—opposite, main section—staggered outside	Ornamental posts	6.6-amp. inverted magnetite	Alabaster globes	
Hartford, Conn. Main Street.	90 ft. bet. bldg. lines	Business structures	Approx. 82 (twin lamp)	112	14	Both curbs—staggered	Twin-lamp ornamental posts	600-cp. gas-filled tungsten lamps	Novulux, Form 1	
Washington, D. C. Pennsylvania Avenue	109	All kinds	123	100	15	Both curbs—staggered	Ornamental posts	6.6-amp. inverted magnetite—standard electrode	23-in. segmented alabaster globe—dense upper, medium lower hemisphere	Well
New York, N. Y. Fifth Avenue (25th to 58th Streets)	60	Business structures	200 (2 per post)	100	19	Both curbs—staggered	Twin-lamp ornamental posts	120-volt, 400-watt multiple gas-filled tungsten lamps	Light Carrara globes	Yes
Corning, N. Y. Market Street		Business structures		100	13½	Both curbs—opposite	Ornamental posts	400-cp., 15-amp. gas-filled tungsten lamps	C. R. I. globe and translucent glass reflectors	
Rochester, N. Y. Lake Avenue	50	Residences	56	400	17½	Both curbs—staggered	Ornamental posts	1000-cp. gas-filled tungsten lamps	Alabaster globes	
Milwaukee, Wis. Grand Avenue	92	Business structures		92	19⅝	Both curbs—opposite	Bracket on trolley pole	4-amp. d. c. series ornamental luminous arc—long life electrodes	Light alabaster globes	Yes
New York, N. Y. Seventh Avenue (110th to 136th Sts.)	80	Apartment buildings	79	105	22	In center of block (on center isle); on curb of intersecting streets at house line of cross-street intersection	Ornamental posts	120-volt, 400-watt multiple gas-filled tungsten lamps	Special ventilated unit—light Carrara globe	
Chicago, Ill. Troy Street.	36	Residences		220	22	East curb	Ornamental posts	600-cp. gas-filled tungsten lamps	Alba globes	No
Washington, D. C. Sixteenth Street	50 ft. (160 ft. bet. bldg. lines)	Residences	246	120	10½	Both curbs—staggered		5.5-amp. series gas-filled tungsten lamps approx. 75 watts	16-in. Alba globes	

declared, is that they give unidirectional light and thus enhance contrast, whereas several small units produce multidirectional light and thereby reduce the discernibility of objects. Attention was called to the fact that devices for producing asymmetrical light distribution have been produced but have not received the extensive trial that their theoretical advantages appear to warrant.

Where it is desirable to give a street a wide appearance and illuminate building fronts and sidewalks at the same time, it may be advisable to mount the lamps over the curbs, whereas if illumination of the roadway is more important, the light sources should be practically over the center of the street to afford the specular reflection in the most favorable direction. Around a lamp which has a dark background there is a zone of halation within which objects tend to become invisible. It is, therefore, very important that lamps be mounted high enough to bring this zone of glare out of the direct line of sight. Lamps may be placed as low as 14 ft. to 18 ft. over curbs with satisfactory results where they are backed by light-colored buildings.

Attention was called to the disadvantages of installing lamps on the inside of curves in roads, much better results being obtained when the light source is on the outside of the curve. To avoid ineffective results due to multidirectional light, which reduces contrasts, spacings need to be greater when the lamps are staggered along both curbs than when they form a line along one side or over the middle of the street.

Discussion

The paper was discussed by Messrs. H. W. Fisher, Perth Amboy, N. J.; Charles R. Underhill, New Haven; G. H. Stickney, Harrison, N. J.; A. T. Baldwin, Cleveland; H. L. Wallau, Cleveland; Chester A. Davis, Cambridge; H. Magdsick, Cleveland; D. C. Jackson, Boston; W. R. Moulton, Baltimore; L. D. Nordstrum, Fort Wayne; John B. Whitehead, Baltimore, and Peter Junkersfield, Chicago.

Mr. Stickney called attention to the fact that there are many features other than efficiency which must be taken into consideration when determining the relative merits of different systems suitable for street lighting.

Mr. Nordstrum stated that the magnetite lamp had proved highly satisfactory at Fort Wayne, Ind.

Professor Jackson said that large lighting units are much preferable to small units for many problems in exterior lighting. He expressed the opinion that the limit of development in illuminating engineering has not yet been even approached, and claimed that what is most needed is the education of electrical engineers along the lines of illumination.

In reply to criticisms of his comparisons of various arc and incandescent lamps, Mr. Millar stated that, since some of the speakers claimed that his comparisons were too favorable to one side and others said that they were too favorable to the other side, he himself believed them to be just about right.

Electric-Railway Contact Systems

Only one formal convention session was held on Thursday, July 1. This was devoted to the general subject of contact systems for electric railways. Six papers were presented, relating to the construction, operation, maintenance and cost of some of the most important overhead and third-rail contact systems of the United States. Difficulties which have been encountered with certain types of construction were described and the methods of overcoming them were outlined.

In the opening paper Mr. Charles H. Jones described the various factors which enter into the construction, operation and maintenance of top-contact, unprotected rails upon which the gravity-type of collecting device is used. He took up the subject under the following subdivisions: Weight of rail, quality of rail, insulating and supporting the structure, bonding and jointing, anchoring, special work required, method of connecting at crossings, and cost of installation and maintenance.

Third-Rail and Trolley Systems of West Jersey Railroad

In the paper by Mr. T. V. B. Duer there were given details of the cost of construction of the contact systems of the West Jersey & Seashore Railroad as originally installed and as subsequently modified and extended. Among the parts described were the third-rail, insulators, rail-protectors, joints and bonds, and trolley structure. Operating experiences were also related on the subjects of creepage of rails, sleet formation on rails, deterioration of bonds, and detention of trains caused by failure of the contact system. Data were also given on the cost of maintaining various contact structures and on the resistance of conductor rails and running rails.

Overhead Contact Systems—Construction and Cost

Mr. Paul Lebenbaum described in detail the 1550-volt overhead contact system used on the Portland division of the Southern Pacific Company. Data were given on the cost of handling and preparing poles for erection, cost of equipping them to carry the conductors, and the material and labor required for maintenance.

Under the above title, Messrs. D. J. Amberg and F. Zogbaum summarized the experiences of the New York, New Haven & Hartford Railroad and the New York, Westchester & Boston Railway. That section of the paper prepared by Mr. Amberg was divided into five sections relating respectively to catenary systems, supporting structures, sectionalization, special construction, and cost data. In the first section were described the double, compound and single catenary systems employed on the New Haven system. The conditions for which each type are best adapted were also outlined. The supporting structures used on the main-line tracks carry the transmission lines, feeders and signals as well as the contact wires. Cross-span construction has been used in all yards, but poles with brackets are employed on single-track sections and industrial sidings. Sectionalizing stations are located at the principal crossovers and are equipped with outdoor-type oil switches controlled by relays. At the sectionalizing points are used two types of catenary gaps, rigid and flexible.

In his contribution Mr. Zogbaum pointed out that periodic inspection of contact wires and transmission systems may forestall possible failures. Although on some roads it has been found advisable to stagger the contact wires in order to make pantagraph shoes last the maximum length of time, this expedient has not been thought necessary on the Westchester road. Attention was called by the author to the need of allowing for the swaying movement of trains on curves.

Contact System of the Butte-Anaconda Railway

An outline of the study made before selecting the contact system used on the Butte, Anaconda & Pacific Railway was given in the paper presented by Mr. J. B. Cox. This outline was followed by descriptions of the modified pantagraph collector, special hangers, pull-offs, and other line material which tends to add unevenly distributed weight or local stiffness to the wires. Attention was called to means provided for swinging the trolley wires out of the way on one section of the line so that derricks can be operated on cars. The methods of sectionalizing lines, constructing trolley-wire junctions at switching points, and crossing over foreign railroads were described. Data were given on the cost of electrifying the road, unit cost of labor, maintenance of distribution expense, and wear of trolley wire and collectors. Some of the difficulties experienced with the

contact system were outlined, and methods adopted to overcome them were cited. The paper was concluded with data on the voltage drop and energy consumption with different trains.

Contact Conductors and Collectors

The conditions required for successful current collection were discussed in a paper entitled, "Contact Conductors and Collectors for Electric Railways" by Mr. C. J. Hixson. In the discussion collectors were divided into two general classes, contact-rail collectors and trolley-wire collectors, and then further subdivided into third-rail shoes, overhead shoes, center shoes, underground shoes, roller trolleys, and slider trolleys. The service to which each type is best adapted was pointed out. The relative advantages of direct and messenger suspension of contact wires were also discussed. The author showed that uniform flexibility of contact wires is essential to successful current collection, presenting curves to show how the wires are deflected by collectors passing along them. Other curves were shown indicating the rapidity with which different types of collector supports respond to changes in conductor elevation, variations in contact pressure with changes in position of the collector support, wear occurring with sliding contacts, and trolley-wire displacement due to wind.

Discussion

The railway contact papers were discussed by Messrs. D. C. Jackson, Boston; L. D. Nordstrum, Fort Wayne; George R. Hill, Schenectady; H. M. Hobart, Schenectady; A. S. McAllister, New York; R. L. Allen, Syracuse; D. D. Ewing, Lafayette; J. V. B. Duer, Ferdinand Zogbaum, J. B. Cox and C. J. Hixson.

Professor Jackson, who as chairman of the electric-railway committee of the Institute had read the paper by Mr. Jones on account of the absence of the author, expressed the opinion that the problems encountered in heavy electric-railway work in this country differ so markedly from those solved by foreign engineers that American engineers are forced to "work out their own salvation" rather than depend upon aid from abroad.

Mr. Hill stated that the wear on a dry contact is from twenty to fifty times as great as that on a lubricated contact. It is highly important to take into consideration the reaction voltage in the rails as affecting the opening of the circuit. To counteract this effect it is at times found necessary to install surge protectors.

Mr. Hobart outlined a type of protected third-rail developed by Mr. J. A. F. Aspinall for use in England. The rail is of the side-contact type without roof. In reply to a question by Dr. McAllister as to the effect of sleet, Mr. Hobart stated that no trouble had been encountered in this respect. Professor Jackson remarked that England is so free from sleet that the sleet problem can be ignored, whereas in America sleet constitutes one of the most serious difficulties encountered.

In reply to a question by Mr. Allen, Mr. Zogbaum said that wood has proved as reliable as porcelain as an insulating material for railway service.

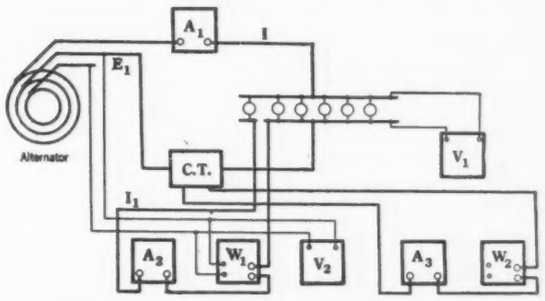
Professor Jackson stated that tests have been begun in Boston looking toward the accurate determination of the self-induction and skin effects in third-rails.

A Simple Method of Determining Phase Displacement in Series Transformers

Several methods of ascertaining the phase displacement in series transformers by means of ordinary portable instruments were described in a paper on "The Phase Angle of Current Transformers," by Mr. Chester L. Dawes. In each case the series transformer under test, an ammeter and a bank of lamps are connected in series with one phase of a three-phase alternator. Wattmeters, voltmeters and ammeters are used in the auxiliary circuits. By the first method the lamp bank is split so that a portion of the current can be sent through an ammeter and the series coil of a wattmeter, while a series circuit consisting of the shunt coil of the wattmeter and a condenser or inductor are connected across the remainder of the load. The condenser or inductor is employed to reduce the power-factor of the load supplied through the series transformer so that the phase angle will be increased. Each of the instruments is then read and the power-factor angle determined by the formula

$$\theta = \cos^{-1}\frac{W_1}{E_1 I_1}.$$

When this has been done the series circuit of the wattmeter, including the ammeter before mentioned, is connected with the secondary of the series transformer, heretofore short-circuited, and the potential circuit left unchanged. The current through the wattmeter and the generator voltage are then adjusted to the same values as before, and the wattmeter is read again. The difference between this reading and the former one will be



CONNECTIONS FOR DETERMINING PHASE DISPLACEMENT IN SERIES TRANSFORMERS

due to the phase displacement in the transformer, so that the following will hold true:

$W_2 = E_2 I_2 \cos(\theta \pm \beta)$, where β is the phase angle.

$$\text{Then } (\theta \pm \beta) = \cos^{-1}\frac{W_2}{E_2 I_2} = \cos^{-1}\frac{W_2}{E_1 I_1}.$$

$$\text{Solving with } \theta = \cos^{-1}\frac{W_1}{E_1 I_1} \text{ gives}$$

$$\beta = \cos^{-1}\frac{W_2}{E_1 I_1} - \cos^{-1}\frac{W_1}{E_1 I_1}.$$

Corrections were given for the error of phase of the part of the primary current which passes through the wattmeter, and separately for the error of phase in the primary caused by the fact that the primary current is not exactly in phase with the voltage used to supply the wattmeter. Another method was described in which these corrections are obviated by changing one of the connections. Still another method was described in which the use of condensers or inductors was eliminated by connecting the shunt coil of the wattmeter with a different phase from that with which the load was connected. The apparatus and connections required in this method are illustrated herewith. Instruments A_3 and W_2 should be similar in characteristics to A_2 and W_1 respectively, and are used to serve as a check on unbalancing of the load only. In the position shown

$$\frac{W}{EI} = \cos\theta.$$

To obtain $\cos(\theta \pm \beta)$ the series circuit of A_2 and W is interchanged with that of A_3 and W_2. From these values β can be determined. Results obtained by each

of these methods were given. They were checked by measuring the phase angles of the transformers with the Drysdale alternating-current potentiometer.

Calibrating Series Transformers with Mutual Inductors

The design, manufacture and method of assembling apparatus for measuring the transformation ratio and phase displacement of series transformers were points discussed by Mr. Charles Fortescue in his paper on the calibration of series transformers. The apparatus used consisted of two ring-shaped marble-core mutual inductors connected with the series transformer under test, and a synchronous contactor and galvanometer. The advantages of this equipment, the author pointed out, are its use for numerous other purposes; it is highly sensitive but not affected by stray fields, and the mutual inductors can be designed, manufactured and calibrated with less expense than reliable non-inductive resistors used for similar purposes. Methods of conducting several tests with this apparatus, such as measuring transformation ratio and phase displacement of series transformers, and determining mutual inductance, self-inductance and alternating-current resistance, were explained.

Discussion

The combined discussion on the papers by Mr. Dawes and Mr. Fortescue was participated in by Messrs. G. A. Campbell, New York; L. W. Chubb, Pittsburgh; C. H. Sharp, New York; J. R. Craighead, Schenectady; L. T. Robinson, Schenectady; C. W. Bates, New Haven, and the authors.

Mr. Bates said that the results reported by Mr. Dawes were more accurate than the measurements upon which they had been based.

Mr. Dawes stated that the range of application of his method is not limited since it can be applied to a transformer of any current ratio. He remarked that the accuracy is not dependent upon the accuracy of the indicating instruments which as a matter of fact are employed merely for showing constancy of conditions of tests.

Mr. Campbell expressed the opinion that the method described by Mr. Fortescue will be employed extensively on account of its accuracy. He suggested the use of two dynamometers excited in time-quadrature voltages in time-phase with the testing current and in time-quadrature therewith.

Measuring Dielectric Losses with Cathode-Ray Tube

The application of the cyclograph, or cathode-ray-tube wattmeter, to determining dielectric losses, the development of this instrument, some of the results obtained with it, and a study of dielectric losses, were described in a paper presented by Mr. John P. Minton, entitled "An Investigation of Dielectric Losses with the Cathode-Ray Tube." The theory of the cyclograph was developed and its use as a power-factor meter was shown. All the tests embodied in the paper were made at sixty cycles with a generator which produced very nearly a sine wave. Measurements were made of dielectric losses, power-factors and leakage currents for varnished cloths and oil-treated pressboard. Curves presented showed the losses, power-factors and currents plotted against voltage, temperature and percentage of absorbed moisture. The results were then expressed in the form of empirical equations in which power-factor, current and losses are expressed as functions first of voltage, then of temperature, and finally of moisture. As a result of his investigations, the author concludes that for good insulation the current should vary directly as the applied voltage; that the losses show clearly the electrical value of an insulation; that the power-factor of insulation may vary from 2 to 99 per cent; that the watts do not vary as the square of the voltage, but may vary from the 1.32 power to the 2.52 power of the voltage; that the weakening effects in insulation may increase as much as the fifth or sixth power of variations in temperature; that the weakening effects in pressboard, and very likely in other water-absorbent insulations, may also increase as much as the fifth or sixth power of the percentage of absorbed moisture.

Discussion

Mr. Minton's paper was discussed by Messrs. H. W. Fisher, Perth Amboy, N. J.; A. S. McAllister, New York; Chester L. Dawes, Cambridge; F. W. Peek, Jr., Schenectady; Charles L. Fortescue, Pittsburgh; Harris J. Ryan, Palo Alto, Cal.; C. H. Sharp, New York, and the author.

Mr. Fisher read a communication written by himself and Mr. R. W. Atkinson in which there were outlined methods of making tests on cables at Perth Amboy, and Mr. Dawes outlined tests being made at Cambridge.

Dr. McAllister called attention to the fact that, since the loss in a solid dielectric was found to vary at a rate different from the second power of the voltage, probably a change was produced in the material by the variation in temperature in such a way as to vary the conductivity with changes in the voltage and the temperature.

Mr. Peek presented a formula for representing the loss based on constant resistance in series with constant capacity variously proportioned and distributed throughout the material showing that the loss should vary directly with the frequency and with the second power of the voltage. In relative values with a loss of five for glass the loss would vary between seven and ten in varnished cambric, and between two and fifteen in oiled pressboard.

Professor Ryan outlined briefly the progress in electrical measurements made during the last thirty years. He remarked that Mr. Minton's paper is chiefly notable in showing that the cathode tube is in a class by itself; in presenting simple expressions for the power factor and in collecting much valuable data concerning dielectric losses. He stated that without making any change whatsoever in the adjustments the cathode tube arranged for sixty-cycle testing can be employed at once for 180,000-cycle testing. He expressed the hope that the tube would be made available to all persons who have use for it.

Economic Operation of Electric Ovens

Mr. Percy Wilcox Gumaer presented a study of the operation and design of electric ovens, with the view of determining some of the factors which will increase the popularity and economy of electric cooking. With cheap fuels and inefficient stoves, it makes little difference whether a particular article of food is cooked for half an hour at 200 deg. C. or for one hour at 150 deg. C., as long as the quality is satisfactory. With electric cooking, however, the temperature at which food is cooked makes a considerable difference in the cost of cooking. In order to determine the losses of energy in electric cooking and the best methods of preparing various articles of food in electric ovens, tests were made on three commercial ovens and on an experimental oven. Each commercial oven was selected as representing a general type of electric oven in use for domestic cooking. The experimental oven was constructed by the author in order to obtain data on the characteristics of an especially well-insulated oven. The temperature of the ovens was measured by means of copper-constantan thermocouples. A number of experiments were made with roast beef, showing the times of cooking for "rare," "medium rare" and "well done" roasts under five different temperatures, ranging from 100 deg. C. to 180 deg. C. Other experiments were made with biscuits, bread

and cakes. The results of the author's experiments, showing the most economical time of cooking of certain foods, concluded the paper.

Discussion

The paper was discussed by Messrs. D. F. Henderson, Seattle; R. W. Pope, New York; H. L. Wallau, Cleveland, and M. G. Lloyd, Chicago.

Mr. Henderson stated that although the first cost of electric ranges is high, yet the cost of operation is not excessive, and they have proved satisfactory in Seattle where 100 ranges are in service. The cost for a small family is no greater than that of gas for the same service.

Mr. Wallau stated that the cost of electric cooking service in Cleveland has been found to vary from $1.50 to $2.50 per person per month.

Dr. Lloyd called attention to the advantages of low-temperature cooking from the standpoint not only of economy in energy consumption but also in results obtained in the kitchen. He said that the automatic devices necessary for scientific cooking have already been developed and are now available on the market.

Class Rates

In his paper on "Class Rates for Light and Power Systems or Territories," Mr. Frank G. Baum urged the principle of uniform rates throughout a system or territory for different classes of service. Business, it is held, will develop most naturally if energy and demand charges are divided as nearly as possible in response to natural, normal costs, and the business of the various classes will develop most naturally if each class is made to bear its fair share of costs, having due regard for the fact that as a matter of policy it should be remembered that the low-class motor-service business promotes industrial and agricultural activity and tends to build up a stable and prosperous community and hence indirectly increases also the lighting business.

It is believed to be better for all concerned to have uniform average class rates with a sliding scale than a large number of different rates for each class. Under the system which is recommended rates would be investigated and fixed by classes to correspond with the judgment of the rate-making body as to what is the proper rate for that class in consideration of the class of service, the different costs to different companies to supply that service, and the general question as to whether the particular industry of the class tends to develop other business and make for a prosperous community or state. Class rates worked out for an entire system will necessarily be more stable than where they are worked out locally. Rates then would not change because a new substation or distribution system was installed at some local point, but would be determined for the entire system's investment and operating condition.

If each class of consumer is made to bear his equitable cost it is believed that the "value of the service" is brought naturally and automatically into account. Rates so determined will develop naturally all normal business. In regulating rates for different consumers in a city it has been found best and necessary to make uniform rates independent of the difference in cost due to different distances from the central station to the consumer.

With consideration of the local situation in a town or district the tendency will be to disregard largely the effects of the local situation on the remainder of the system. This method accentuates the "cost of service" and practically ignores the "value of the service" or the "reasonableness of the rate" from the consumers' standpoint. On the other hand, by consideration of the classes of business and an effort to determine average class rates for the system, there will be a tendency for rate-makers to consider "value of service" and "reasonableness of the rate" from the consumers' standpoint. It is not a far step from the determination of average class rates for a system to a method of class rates which will make the rate for a given class of service the same even if the service is in different cities or is supplied by different companies.

The application of uniform class rates for a system or territory will tend: (1) to make rates simple, fair and definite; (2) to make them equitable as between classes of consumers; (3) to make them uniform so as to cause them to become standard for similar conditions; (4) to produce economy in construction and operation, and hence, as a result of the above, (5) rates will tend to be reduced as the volume of business increases.

Discussion

Those who took part in the discussion of Mr. Baum's paper (which was abstracted by Professor Hobart in the author's absence) were Messrs. W. J. Norton, Chicago; H. L. Wallau, Cleveland; M. G. Lloyd, Chicago; S. N. Clarkson, St. Louis; E. L. Wilder, Rochester; J. W. Welsh, Pittsburgh; H. M. Hobart, Schenectady, and R. W. Pope.

Mr. Norton contended that rate making is an art and not a theory. Existing rates are the growth of years, based on incomplete information. Great progress in rate making has been made in California and theoretical rate making has been carried far there. It must be remembered, said the speaker, that theoretical calculations are full of assumptions which cannot be checked. Expediency is an element in rate making.

Mr. Wallau said that the advantages of uniform rates for class service are obvious, but the rates should recognize individual as well as class load factor. Mr. Baum's method necessitates separate metering for lighting and motor service, whereas joint metering gives a purchaser the benefit of his own diversity of demand.

Dr. Lloyd stated that most of the principles in Mr. Baum's paper are well recognized, but he raised the question as to whether or not these rules would apply when two companies are operating in the same community. He believed that a company should be allowed to get a better return when its management is more efficient.

Mr. Clarkson considered that the conditions on the Pacific Coast, for which the paper was written, are not duplicated elsewhere. He thought that the class rate at any distance from the station depends upon local conditions. If the load is uniformly distributed the rate should be other than that for loads concentrated near the ends of the line. It is important to remember that cost of energy is only a part of cost of service, and that it is service which is sold.

Mr. Wilder stated that it is important in rate making to furnish an economic motive to improve the load-factor. The use of household devices does improve the load-factor, and rate schedules should furnish an incentive to use such devices. He also described as an example of off-peak load development, the case of a factory which, in slack times, is able to adjust its work to an off-peak power schedule and thus reduce its electricity costs.

Mr. Hobart said that he agreed in the main with the author's recommendations but declared that all that can be done is to set forth the general proposition. There are matters other than load-factor which affect cost, as, for example, power factor. There is no great need that each customer should pay exactly his share of the cost. The community must be equitably served and the corporation provided a fair return.

Cost of Electric Pumping for Irrigation

Results Obtained on South Side Unit of Minidoka Project of United States Reclamation Service—Electricity Supplied at Cost

THE success of an irrigation project depends as much and more upon the annual cost of operation and maintenance as it does upon the original or construction cost. These annual costs, of course, depend upon a great many factors, and there are wide variations on projects which obtain their water supply by direct diversion into gravity canals. When it is necessary to pump the water, many more factors are added, and among them the most prominent are the cost of power, height of lift, and size and type of pumping plant.

The largest pumping scheme yet undertaken is that of the United States Reclamation Service known as the South Side Unit of the Minidoka Project. It includes about 48,000 acres of land along the Snake River in the vicinity of Burley and Marshfield, Idaho. Data showing the cost of pumping on that project has been placed at our disposal by Mr. Barry Dibble, electrical engineer in charge, from a paper prepared for the Idaho Society of Engineers.

Water is raised by large pumping stations up three 30-ft. steps. At each level some water is taken out for the lands that can be covered. The power required is the same as though all the water were lifted to an average height of 66 ft. to 69 ft.

Electricity is supplied from a power plant utilizing a 46-ft. fall in the Snake River at Minidoka Dam. Energy is transmitted about 11 miles from the power house to the pumping stations over 33,000-volt transmission lines. Power-house and transmission lines are operated as part of the project, and energy is supplied to the pumping station at cost. Part of the output is used for some small pumping stations across the river on the North Side Unit and part supplies the electricity needed by the towns and farms within reach. In winter a large amount of energy not then needed for irrigation

FIG. 1—IRRIGATED OAT FIELD NEAR MARSHFIELD

FIG. 4—A FARM SCENE NEAR BURLEY

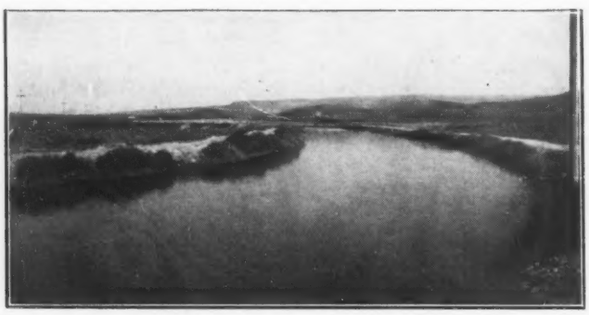


FIG. 2—CANAL BETWEEN PUMPING STATIONS NOS. 1 AND 2

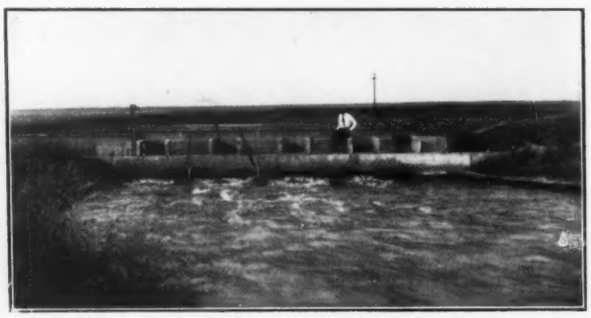


FIG. 5—DISCHARGE FROM PUMPING STATION NO. 1

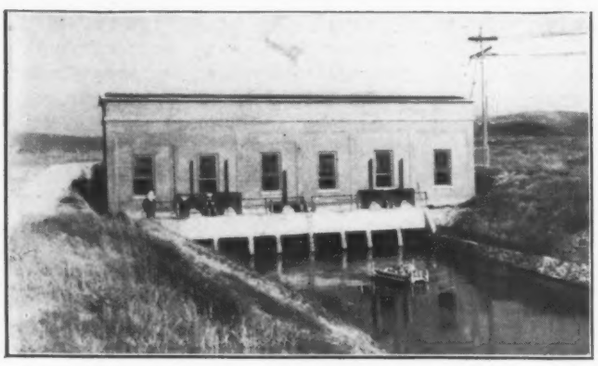


FIG. 3—IRRIGATION PUMPING STATION NO. 3

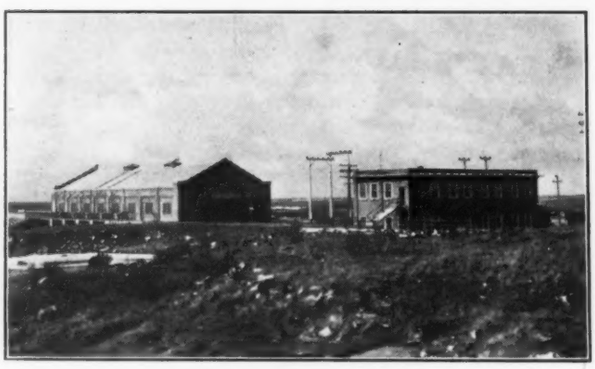


FIG. 6—POWER HOUSE AND SHOP BUILDING

ELECTRIC IRRIGATION SCENES ON THE MINIDOKA PROJECT IN SOUTHERN IDAHO

is used in the towns for heating the stores and houses (ELECTRICAL WORLD, May 23, 1914). The sale of this energy is a material help in reducing the charges that are placed against the pumping load.

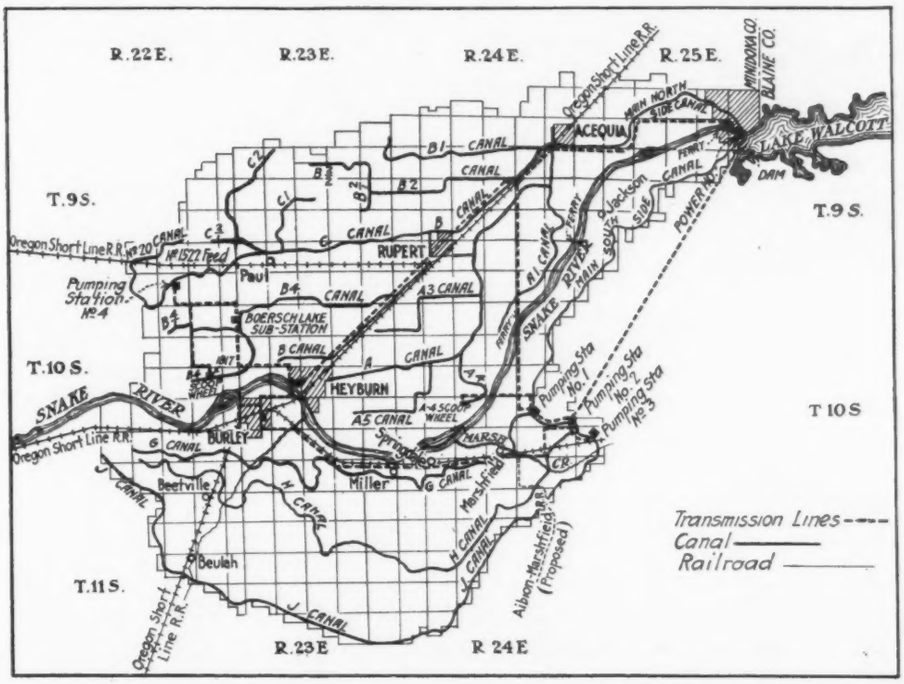


FIG. 7—MINIDOKA PROJECT OF UNITED STATES RECLAMATION SERVICE

useful service. The rest was lost in transmission lines and transformers. Therefore there is quite a difference between the cost per kilowatt-hour delivered and the cost per kilowatt-hour generated. For 1914 the distribution was as shown in Table II, the cost per kilowatt-hour delivered being $0.0012.

The transmission lines on the project now form a system of about 65 miles, the operating costs of which are all kept together. Two linemen do most of the work on this system and in addition take care of 150 miles of telephone line and some construction. The costs are given in Table III.

Some of the features require for their use much longer transmission lines than others, and the costs are, therefore, divided on a mileage basis. The result for 1914 is given in Table IV. These figures show as chargeable to the South Side Unit:

Power-house cost per kw.-hr. delivered	$0.00120
Transmission cost per kw.-hr. delivered	0.00020
Total cost per kw.-hr. delivered at South Side pumping stations	$0.0014

The South Side Pumping Unit has been operated since 1909, long enough to permit of an interesting record. However, in studying the figures, attention is called to the fact that only a small portion of each plant was in use in 1909 and the main installation was not completed until early in 1912.

On the Minidoka Project depreciation has not been collected, and interest is not included because no interest is charged on the money invested in the project. What it would amount to may be readily calculated by applying any rate to the investment chargeable to the South Side Unit, which in round numbers is $1,000,000. About one-half of this sum is the cost of the pumping stations. The remainder represents the proportionate cost of power house and transmission lines.

Table I gives the annual cost at the power house. This plant has a rating of 10,000 hp. The station is regularly operated with two men on a shift, three shifts in a day. A foreman and assistant have general charge. All the figures given for 1914 are for the year Dec. 1, 1913, to Nov. 30, 1914.

Although over 30,000,000 kw-hr. was generated in 1914, less than 25,000,000 kw-hr. was accounted for in

FIG. 8—INTERIOR OF MINIDOKA POWER HOUSE

This, of course, represents the cost of delivering a very large block of energy at high voltage and should not be considered as the cost of delivering in retail quantities, which would naturally be much greater.

The peak delivered to the South Side pumping station during 1914 was approximately 6300 kw. The gross cost of this delivered power was:

Portion of power house	$20,739.00
Portion of transmission lines	3,475.00
Total for energy delivered	$24,214.00
Per horse-power of season's peak load	2.88

If interest on the investment in power plant and transmission lines, say at 6 per cent and amounting to $30,000, be added to these figures, it would increase the cost by $3.58 per hp, making a total of $6.46 per hp of peak demand for the season.

The three South Side pumping stations are operated exclusively for the benefit of the South Side Unit. Some overhauled, and most of the crew is then laid off or transferred to other work. Since 1910 the amount of land irrigated and the water pumped has very greatly increased, but, as will be seen from Table V, the cost of operation and maintenance has not materially changed. The depreciation item has increased, however, with the addition of new machinery. For ready comparison with other plants the unit of cost has been taken as the acre-foot lifted 1 ft. high, or the "foot-acre-foot."

To get at the amount by which the running costs of this project are increased because pumping is necessary all the items due to this feature can be combined. Using 1914 as an example, the results in Table VI are obtained.

As has been noted above, only items included in the first column are charged to the Minidoka settlers. It may be in this case that the increase in the outside sale of energy in the winter time will help to keep down the increase in charges which would otherwise occur when the time comes that depreciation has to be reckoned with.

It may be added that the annual cost of operating and maintaining the canals and laterals, for getting the water to the land, amounts to about 75 cents per acre

interesting work has been done within the past year, increasing the capacity of the pumps. This work has resulted in the supply of 30 per cent more water at very little additional expense. Some of the changes were completed for the season of 1914 and gave capacities of 665, 550 and 325 cu. ft. per second, respectively for the three stations. One man is required to operate each station on each shift. A foreman has general supervision of all the stations and has one or two helpers to keep the machinery in shape. Late in the summer extra men are usually needed to rake the moss and weeds from the trash racks.

After the pumping season all machinery is thoroughly

TABLE I—POWER HOUSE—OPERATION, MAINTENANCE AND DEPRECIATION CHARGES

Year	Kilowatt-Hours Generated	Gross Cost			Per Kilowatt-hour Generated		
		Operation and Maintenance	Depreciation	Total	Operation and Maintenance	Depreciation	Total
1909...	2,757,000	$5,197.00	$2,229.00	$7,426.00	$0.00187	$0.00082	$0.00269
1910...	10,000,000	8,949.00	8,805.00	17,754.00	0.00090	0.00088	0.00178
1911...	18,202,000	10,156.00	12,856.00	23,012.00	0.00055	0.00072	0.00127
1912...	20,092,800	12,613.00	14,057.00	26,669.00	0.00063	0.00070	0.00133
1913...	25,661,420	16,028.00	14,100.00	30,128.00	0.00062	0.00055	0.00117
1914...	30,069,993	15,191.00	14,615.00	29,806.00	0.00051	0.00048	0.00099

TABLE II—DISTRIBUTION OF ENERGY IN 1914

	Kilowatt-Hours	Amount
Pumping, South Side Unit	17,314,700	$20,739.00
Pumping, North Side Unit	242,848	292.00
Pumping for drainage	1,026,824	1,228.00
Drainage construction	715,235	856.00
Sold to consumers	5,593,678	6,691.00
Total	24,893,285	$29,806.00

TABLE III—TRANSMISSION LINES—OPERATION, MAINTENANCE AND DEPRECIATION CHARGES

Year	Kilowatt-Hours Delivered	Gross Cost			Per Kilowatt-hour Delivered		
		Operation and Maintenance	Depreciation	Total	Operation and Maintenance	Depreciation	Total
1909...	2,250,000	$775.00	$846.00	$1,621.00	$0.00034	$0.00038	$0.00072
1910...	8,867,275	779.00	1,907.00	2,686.00	0.00009	0.00021	0.00030
1911...	14,445,000	3,317.00	2,019.00	5,336.00	0.00023	0.00014	0.00037
1912...	17,788,175	2,441.00	3,611.00	6,052.00	0.00014	0.00020	0.00034
1913...	23,316,295	1,780.00	4,178.00	5,958.00	0.00008	0.00018	0.00026
1914...	24,893,285	2,394.00	5,147.00	7,541.00	0.00009	0.00021	0.00030

TABLE IV—COSTS FOR 1914 ON MILEAGE BASIS

	Kilowatt-Hours	Gross	Per Kilowatt-Hour
Pumping, South Side Unit	17,314,700	$3,475.00	$0.00020
Pumping, North Side Unit	242,848	423.00	0.00174
Pumping for drainage	1,026,824	1,028.00	0.00100
Drainage construction	356,370	158.00	0.00044
Sold to consumers	5,593,678	2,457.00	0.00044
Total	.....	$7,541.00	$0.00030

TABLE V—SOUTH SIDE PUMPING STATIONS—OPERATION, MAINTENANCE AND DEPRECIATION CHARGES

Year	Acre-Feet	Average Lift, Feet	"Foot-Acre-Feet"	Gross Cost			Cost per "Foot-Acre-Foot"		
				Operation and Maintenance	Depreciation	Total	Operation and Maintenance	Depreciation	Tota
1909.	23,300	66.0	1,537,800	7,055	2,528	9,583	$0.00460	$0.00166	$0.00626
1910.	69,900	65.7	4,582,430	11,404	10,226	21,630	0.00250	0.00223	0.00473
1911.	98,200	65.6	6,441,920	10,668	13,955	24,623	0.00165	0.00220	0.00385
1912.	99,500	66.0	6,567,000	14,849	17,400	32,249	0.00226	0.00265	0.00491
1913.	118,688	68.0	8,070,984	12,494	17,428	29,922	0.00155	0.00216	0.00371
1914.	147,212	69.2	10,187,070	14,239	17,993	32,232	0.00140	0.00177	0.00317

TABLE VI—EFFECT OF PUMPING ON RUNNING COSTS

Item	Operation and Maintenance	Depreciation	Total
Power house	$10,570.00	$10,169.00	$20,739.00
Transmission lines	1,103.00	2,372.00	3,475.00
Pumping stations	14,239.00	17,993.00	32,232.00
Total	$25,912.00	$30,534.00	$56,446.00
Cost per foot-acre-foot	$0.00254	$0.00300	$0.00554
Cost per acre-foot	0.176	0.207	0.383
Cost per acre in project (48,000)	0.54	0.636	1.176
Cost per acre irrigated (35,788)	0.725	0.854	1.579

of irrigable land in the project. About 12,000 acres included in the project were not irrigated last year, but their coming in will not materially affect the costs.

Included in the North Side Unit of the Minidoka Project are a number of small pumping stations of vari-

FIG. 9—MOTOR ROOM, PUMPING STATION NO. 2

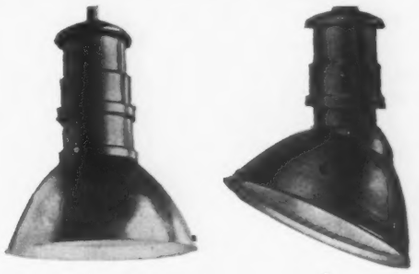
ous types. These have not been operated long enough to make the cost data of much present value. In general, it is to be expected that the cost of pumping will be greater per foot-acre-foot with the smaller plants.

Artificial Daylight in Practice

BY M. LUCKIESH*

It has long been known that ordinary artificial illuminants differ greatly in spectral character from daylight, and many attempts have been made to combine the former or to alter them by means of colored media in order to produce artificial daylight. However, until recently such units have been unsatisfactory for general purposes because the colored medium was either perishable or insufficiently accurate in its selective transmission. Last year there were developed artificial daylight units which have proved satisfactory in long practical tests—the final criterion of acceptability. The development of the colored glass for converting the light from the new gas-filled tungsten lamp into artificial daylight was based on data gathered from various sources on the spectral character of daylight. The experiments and developments which led to a practical realization of artificial daylight were described† about a year ago. Since that time nearly a thousand artificial daylight units have been installed in many different fields.

Originally two chief kinds of daylight were imitated. For accurate color work north skylight is almost universally employed. For this reason a glass was developed which would alter the light of the new gas-filled tungsten lamp to a very close imitation of average north skylight. This glass, as shown by spectrophotometric tests, is not merely a "blue" glass. In fact,



a *b*

FIG. 1—ARTIFICIAL "NORTH SKYLIGHT" UNITS, FOR ACCURATE COLOR WORK

five coloring elements are properly balanced in its composition. It might be noted in passing that the new high-efficiency tungsten lamp has made it possible to obtain artificial daylight at a practical efficiency. However, artificial north skylight cannot be produced at a sufficiently high efficiency to warrant its use for general lighting. Therefore, the north skylight unit (Fig. 1) has been installed only in those places where accurate color discrimination is necessary. The accuracy of this artificial skylight is maintained by pressing the glass to a certain thickness which can readily be kept constant.

There are many instances where less exact color work is done that requires general lighting of a better color value than is available from any of the ordinary artificial illuminants. Therefore, there was developed a colored glass which would alter the light from the gas-filled tungsten lamp to that of noon sunlight. The luminous efficiency of these units is sufficiently high to warrant their use for general lighting. In fact, their luminous efficiency is approximately that of the vacuum tungsten lamp of smaller sizes. These sunlight units (Fig. 2), and others more recently developed for general lighting purposes, are of blown glass, but the ordinary small variations in the thickness of the glass are not objectionable because these units are installed only where the less exact color work is done.

In general, a field for artificial daylight units is always found where colors must be distinguished with more or less accuracy, because daylight has been, and perhaps always will be, the standard illuminant for the

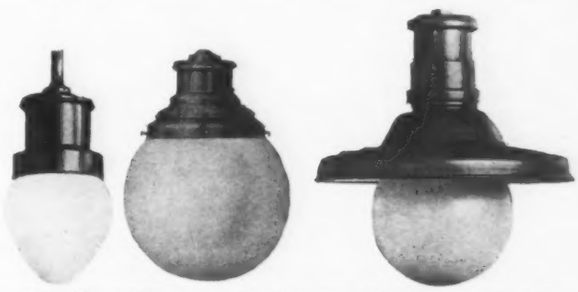


FIG. 2—ARTIFICIAL "NOON SUNLIGHT" UNITS FOR GENERAL LIGHTING FOR COLOR WORK

discrimination of colors. However, daylight varies so in quality and intensity that in numerous cases it has been found advantageous to use the artificial north skylight for all accurate color work. Obviously it is impracticable to provide artificial daylight of many different qualities in order to duplicate in all cases that daylight to which a given color expert has been accus-

---

*Nela Research Laboratory.

†M. Luckiesh, "A Practical Realization of Artificial Daylight," ELECTRICAL WORLD, Sept. 19, 1914; M. Luckiesh and F. E. Cady, "Artificial Daylight—Its Production and Use," *Trans.* I. E. S., Vol. IX, No. 8.

tomed. This has been a source of misunderstanding occasionally, because the color expert does not always realize that his particular daylight has been altered by reflection from both exterior and interior surroundings. Brick buildings, foliage, etc., alter daylight considerably by selective reflection. Likewise the wall coverings in an interior alter the daylight that enters a window very considerably. This can be seen readily by casting a shadow on a white surface held horizontally at some distance from a window. If the walls and ceiling of the room are painted yellow, for instance, the shadow will appear decidedly yellow in comparison with the remainder of the white surface. In all instances, however, the color expert has found it easy to adjust his color perception to the artificial north skylight illuminants.

Now that artificial daylight units have been installed in a variety of fields and have proved satisfactory, it may be of interest to describe some of these briefly.

Many color-matching units have been installed in department stores and wholesale dry-goods and millinery stores. In most cases individual units have been placed over counters; however, color-matching rooms

FIG. 3—ARTIFICIAL SKYLIGHT IN USE

have been equipped with several of the units concealed in the ceiling.

For general lighting the sunlight units have been installed throughout entire floors in dry-goods, paint and wall-paper stores and in wholesale millinery and dry-goods stores.

In several paint and varnish factories the color-matching units have been utilized in the laboratories and the sunlight units have been used in paint shops.

Several artists are using skylight units for easel work. The sunlight units have been installed in an art school for general lighting for night classes. These also have proved satisfactory in lithographing art rooms where the color work is less exacting. However, the skylight units have been employed where inks are mixed and over the color-printing presses in order to save the time required to go to a window with the proof sheets. In fact, in one case where the color-printing presses were in the basement it was necessary before the installation of the skylight units to carry the proof sheets to the top floor for examination. Several tailor shops have been equipped with sunlight units, and in one case these units are used for general lighting in the work shop, display room and show windows.

A special unit (*b*, Fig. 1) was designed for a textile mill. This angle unit is employed for illuminating dyed goods as the latter hang vertically. Many of these units are already in use in textile mills.

In several paper mills and one oil-refining plant skylight units are employed for accurate color work. In the former cases the unit is utilized for mixing dyes in order to tint tons of paper to exact shades. In the refining plant the unit is used for inspecting the color of oils.

The artificial skylight units have met with favor in cigar factories, where they are used for sorting cigars and leaf tobacco. A large laundry is equipped over an entire floor with sunlight units.

Several art showrooms and one art exhibit have already been lighted with the sunlight units, and it is likely that one of the largest art museums in the world will soon be lighted with artificial daylight throughout.

New and sometimes unexpected uses for artificial-daylight units are continually arising. Sunlight units have been installed in the operating room of a hospital, and physicians have found the daylight units useful for diagnosing manifestations of skin diseases. A large group of dentists have commended the use of artificial skylight for selecting and matching artificial teeth. A similar use is found in the matching of buttons. Recently night classes in horticulture were organized in a technical high school and ordinary artificial light was found to be unsatisfactory. Twenty-six sunlight units were installed in the greenhouse, thus making it possible to carry on the night work with the same satisfactoriness as in the daytime. A photographer has adapted the sunlight units for viewing transparent autochrome portraits. A chemist in a steel mill had difficulty in recognizing certain chemical reactions at night, and inasmuch as the steel mills operate twenty-four hours per day, the artificial skylight proved very helpful. Several jewelers are purchasing diamonds under artificial skylight. The slightest color. can be detected as readily as in daylight. Yellow stones are particularly difficult to detect under ordinary artificial light.

Another interesting field is that of microscopy. Biologists especially have commended the use of artificial sunlight for such work. Hairdressers and chiropodists have approved the use of both types of artificial daylight in their work. A leading hotel is contemplating the use of the sunlight units for the general lighting of sample rooms and of skylight units for accurate rendering of color values. Salesmen have requested a special portable unit for shipment in sample trunks, thereby making it possible to meet customers at night.

While the accurate discrimination of color is not of prime importance in offices, the sunlight unit has met with favor where daylight is of insufficient intensity. The writer has experimented for several years with artificial-daylight desk lighting. The lack of color difference between artificial and natural light is apparently quite an improvement where the two must be used simultaneously. This may be largely a matter of taste, but the problem is worthy of study.

Many other uses have arisen, and other units are being developed as the needs and demands have been ascertained. The above brief descriptions have been presented to show that artificial daylight has been produced at a sufficiently high accuracy and luminous efficiency, and that there is a popular demand for it. Such installations are inevitably accompanied by an increased power consumption, and in many cases new sockets are used. This condition meets with the approval of the central station and others interested in lighting, and the results of the past year indicate that the consumer is satisfied. There are many developments to come in

the alteration of the quality of light in the art and science of illumination, but none demands such high accuracy as the production of artificial daylight. This problem has been solved scientifically, and certainly there is no place in the lighting field for so-called daylight units that have no scientific foundation underneath their development. The approval of artificial daylight units by the users indicates that the efforts of the lighting expert are bearing fruit. The consumer is beginning to realize that efficiency in lighting is the ratio of satisfactoriness to cost and not merely the reciprocal of the cost.

Panel Box for Industrial Plants

BY CHARLES J. WHITFIELD

In these days electricity is used in practically all industrial plants. Panel boxes are now deemed necessary in these installations to provide a housing that will protect the switches and fuses that must be inserted between the electric mains and the energy-consuming devices installed around the plant.

Since the continuity of operation of the motors driving machinery or of the lamps illuminating the plant may depend upon non-interference with the switches and fuses that are incased in the panel boxes, it is obviously essential that these boxes should be so constructed that the devices they contain cannot be readily interfered with. This requirement of non-interference can be easily attained in plants manufacturing a relatively light product and where the workmen are intelligent. However, in foundries and rolling mills and plants of similar types where the product is heavy and where the operatives are frequently rough and careless, a panel box to be a real protection must be very substantially constructed. The construction that is detailed in this article was designed for extremely severe conditions. It can be made less rugged or modified accordingly when it is utilized for an installation where the requirements are not so stringent. A front view of a typical cover is shown in Fig. 1, and Fig. 2 illustrates the general assembly of the box. All of the construction and details shown are typical and can be applied to

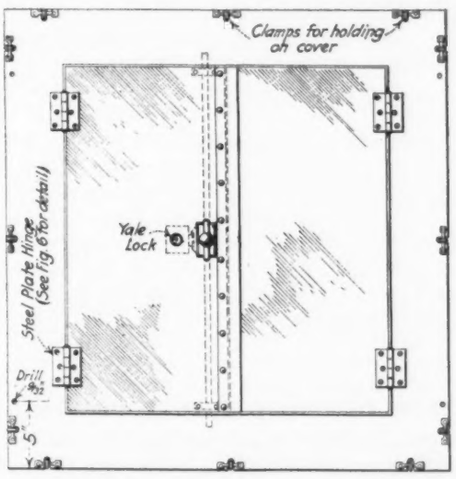


FIG. 1—FRONT ELEVATION OF TYPICAL COVER

boxes of any reasonable size. The height and width of any panel box is determined by the capacity and number of the fuses and switches that must be mounted on a panel that it contains. The design of suitable fuses and switches is thoroughly standardized, hence no particular description of the electrical features of a panel box will be attempted.

The box itself is either built up or pressed from 3/16-in. mild-steel plate. The thickness of 3/16 in. does not appear to be justified under ordinary conditions, but under severe conditions it should be used. Certain panel-box manufacturers are prepared to press boxes from the steel plates and thus form the rounded corners shown in Fig. 4. Where this method of construction

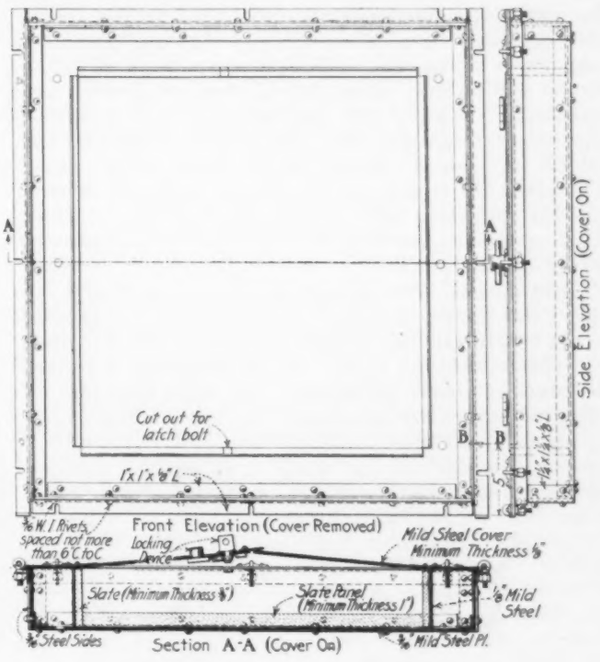


FIG. 2—GENERAL ASSEMBLY OF BOX

can be used it is preferable to the application of a 1-in. by 1-in. by ⅛-in. angle at the bottom corner of the box, which is shown in Fig. 2. Another 1-in. by 1-in. by ⅛-in. angle is riveted around the outside of the upper edge of the box, both to reinforce it and to afford a means, described later, of attaching the cover. The slate panel, which is a part of the electrical equipment, is held to the bottom of the back of the box with screws. The barriers which form the wiring gutter are of slate and are reinforced with ⅛-in. mild-steel plate held thereto with machine screws. This reinforcement has been found necessary because the barriers are usually broken unless reinforced. The wiring gutter provides a raceway for the conductors, which should be brought to the box in conduit.

The conduit enters at the side or top of the box, and the conductors from them can then be carried around in the wiring gutter to points opposite any switch or fuse on the panel. Then the wires are passed through a hole in the barrier and connected to the switch or fuses.

It is obvious that access to the gutter is necessary in wiring a box. Hence the entire cover must be removable. The cover (Fig. 1) is held to the face of the box with the hexagonal nuts arranged as shown in Fig. 2. Twelve should be used for boxes shorter than 4 ft. For longer boxes two clamps should be added for each 2 ft. increase in length. These nuts can be started with a wrench and turned for the rest of the distance along the screw with the fingers. The end of the bolt on which they turn is headed over, so that the nuts cannot be lost. When a repair man must quickly obtain access to the fuses and switches of the panel box, he can do so by merely inserting his key in the lock and turning the bolt handle. Then the doors will open and he can open a switch or change fuses. When it is necessary to run new circuits or to make changes in wiring, the

entire cover must be removed. This is done by unscrewing the bolts. Although even an unauthorized person can, by doing some work, gain access to the panel box by unscrewing all of the nuts holding on the cover, no difficulty has been experienced from this source. Common machine screws have been used for holding the covers on boxes, and while the screws will hold the cover after they are in place, the objection to the method is that the wiremen lose the screws. After the cover has been taken off and replaced possibly a half dozen times, the probabilities are that all of the screws will be lost. Then the wireman will adopt some makeshift, unsightly and unsubstantial method of holding the cover on. For this reason some device that cannot be lost should be adopted for securing the cover.

Another advantageous feature of holding the cover on with hexagonal nuts is that even if a wireman loses his keys he can get into the panel box if necessary by taking off the cover.

Cover-holding pins or dowels, detailed in Fig. 3, are set in the reinforcing angles around the outside edges of the box to provide temporary supports for the cover. The pins consist of ¼-in. machine screws, cut off and the edges rounded. In replacing the cover the wireman will hang it on these holding pins until he can set up three or four nuts which will assume the weight while the other nuts are being tightened.

When this type of panel box was first designed some difficulty was experienced in securing a suitable butt or hinge for the cover. A substantial hinge, 2⅞ in. by 2⅛ in. by 1/16 in., as shown in Fig. 1, was finally employed. This has six holes and is fastened to the plates of the cover with six flat-head machine screws which are riveted on the inside.

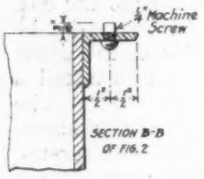


FIG. 3—COVER-HOLDING PIN

FIG. 4—METHOD OF BENDING CORNERS

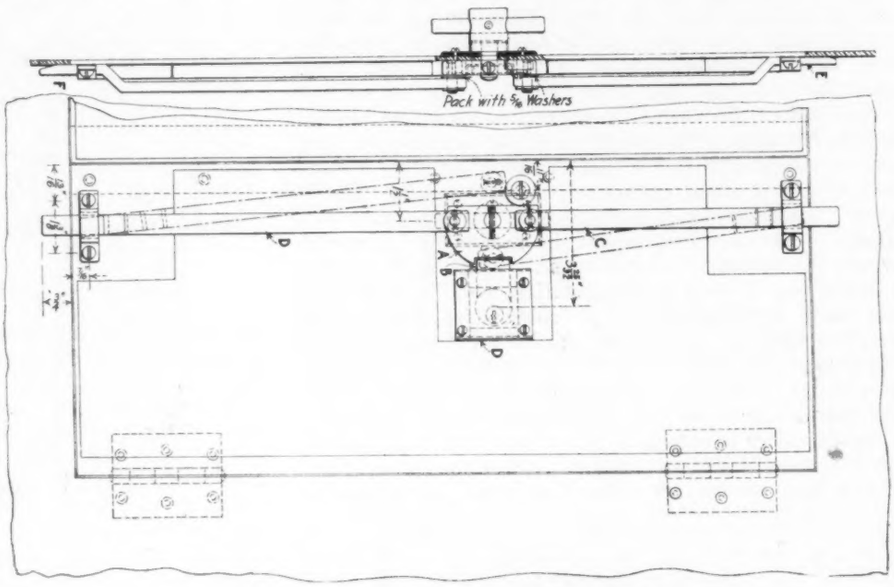


FIG. 5—ASSEMBLY OF LOCKING DEVICE

The locking device used on the box is a feature that required considerable thought and development. It is illustrated in Figs. 1, 2 and 5. Referring to Fig. 1, when the wireman inserts his key in the lock and turns it the lock bolt *B* (Fig. 5) will be turned back. This permits the operating handle to be turned. This draws the bolts *C* and *D* and permits both doors of the box to be opened. When the wireman desires to close the box he shuts the doors and turns the operating handle back to a vertical position. This shoots the bolts *C* and *D*, and the spring bolt *B* of the lock will engage in the notch in the cam casting *A*, which locks the box. It should be noted that the box really automatically locks itself when the wireman closes the doors, hence the boxes are rarely left unlocked.

The spring lock *D* that is used is a Yale & Towne paracentric drawer lock No. 5561, equipped with square selvage, square spring bolt and solid box. German-silver keys are furnished, and all of the boxes in the plant of the industrial corporation that uses them can be operated by the same key. The lock shown is of standard construction except that the spring-bolt feature is special and must be ordered specifically.

The design of the locking device is complicated somewhat by the fact that a slate lining is used on the doors of the panel boxes. This slate lining can be and is in some cases omitted, in which case the design of the locking device can be simplified accordingly. For instance, the cam casting can be made very much thinner, and it will not be necessary to bend offsets in the ends of the locking bars as at *E* and *F* (Fig. 5).

Although one is quite safe in accepting any electrical apparatus that has had the approval of the Underwriters' Laboratories, and most commercial electrical apparatus has had this approval, there are certain features of the electrical equipment that should be carefully considered. Some switches that are approved by the Underwriters' Laboratories, while they would be entirely satisfactory for residence or business-house service, are much too light for heavy industrial-plant installations. One weak point of switch construction is the method of attaching the handle to the switch. It is, for example, not desirable to have a long handle on a switch in a panel box. The long handle not only makes necessary a wider box than would be otherwise required, but when the switch is open the handle sticks out and interferes with the work of the wireman. This feature makes short handles desirable and the item of compactness should always be considered in the design and construction of such boxes.

A Meter, Some Spiders and a Moth Ball

Electric meters in the earlier days of the industry were not always made dust-proof. In fact, it was often possible for wily patrons of some electric-light companies to introduce spiders into their meters through cracks in the cases. One spider if introduced promptly after the meter was read would spin enough web, it was learned, to retard the meter disk and to effect a considerable reduction in the electric-light bill. According to stories told by operators of those early days, a single moth ball if placed in each meter case could be depended upon to eliminate all trouble from spiders.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Commutation Theory.—M. MAUDUIT.—An account of an investigation the object of which was to examine the foundations of the modern commutation theory and to investigate especially what part the transition resistance between brush and commutator segment plays in the phenomena of commutation. The author has developed a special experimental arrangement for the investigation of this problem. One of the important results of his investigation is that the relation between transition voltage from brush to commutator segment and current density is not linear as is often supposed. When the current density becomes infinite, the transition voltage has a finite and comparatively small value. The author thinks it is hopeless to try to investigate analytically the commutation phenomena since the variation to the transition resistance cannot yet be handled mathematically. Since the transition voltage never assumes more than 1 volt or 2 volts, it is not of such great importance for commutation as is usually assumed. The commutation phenomena depend far more on the magnetic fluxes. The author emphasizes that in order to make progress it is necessary to attempt to get as simple a physical view as possible of the phenomena, and for this purpose he recommends the study of the fields and the properties of various sorts of carbon experimentally instead of trying to solve the problem by differential equations the basis of which is uncertain.—*Bulletin de la Société Internat. des Elec.*, Vol. II, Series 3, page 601; abstracted in *Elek. Zeit.*, June 3, 1915.

Lamps and Lighting

Designation and Rating of Incandescent Lamps and Arc Lamps.—A continuation of the extended discussion which followed the recent paper of Solomon on the designation and rating of incandescent lamps. Meng said that if incandescent lamps were to be rated by watts consumed the spherical candle-power should also be stated. Wedding thought that ordinary people have no real idea of what 1 cp. means. Very few of them ever see in all their life a Hefner lamp. To explain the economy of lamps to the general public it might be advisable to give the candle-power per watt and call it the "light output" ("Lichtausbeute"). Passavant thought the general public should and would become accustomed to the rating of incandescent lamps by watts because bills are based on the watt-hours consumed. When the public asks what it gets for its money, the best reply is to say that each watt gives so and so many candles. Dietz referred to the proposition that if incandescent lamps were to be rated by spherical candle-power, arc lamps should be designated and rated likewise, and thought it would be inconsequent under these conditions to propose to test the incandescent lamps without fittings and the arc lamps within their fittings. Wedding disagreed, and stated that the fitting of an arc lamp is an intrinsic part of the lamp. The measurement of the candle-power of the bare carbons would be a test of carbons but not a lamp test. Schaller said that if the principal object of photometric tests is to permit the carrying out of illumination calculations the knowledge of the lower hemispherical candle-power of an arc lamp is sufficient. To rate arc lamps by their spherical candle-power is not to be recommended, since the whole design of arc lamps is such as to get all the useful light downward.—*Elek. Zeit.*, May 20, 1915.

Arc Lamps Versus Half-Watt Tungsten Lamps.—A. CHEVALIER.—The author discusses the conditions under which modern arc lamps are economically superior to half-watt tungsten lamps and gives various numerical examples. Since pure-carbon arc lamps consume upward of 0.5 watt per candle-power and require attendance, it is evident that they cannot compete with half-watt tungsten lamps. On the other hand, modern flame-arc lamps consume only one-third the energy of half-watt tungsten lamps when giving the same light. In all cases where the cost of electrical energy is not very low the author concludes that the arc lamp is economically superior to the tungsten lamp. He gives three examples. In the first one he compares fifteen 220-volt, 8-amp. direct-current open flame-arc lamps of 1500 cp. each for white light with fifteen 1000-cp., half-watt tungsten lamps. For 1300 hours of operation in the year and a cost of 2½ cents per kw.-hr., he finds that the yearly cost of the arc lamps is $400 and that of the tungsten lamps is $575, or 44 per cent higher when giving the same light. In this example the cost of the tungsten lamps would be equal to that of the arc lamps if the cost of the energy was reduced to 1.25 cents per kilowatt-hour and interest and amortization were included. The second case relates to street lighting, 1000 hours a year, with a price of 1.25 cents per kilowatt-hour, direct-current. The cost of 100 closed flame-arc lamps in this case is $1,278, and the cost of 100 tungsten lamps is $2,031. The third case relates to street lighting for 2000 hours a year at a price of 1.25 cents per kilowatt-hour, alternating-current. For 250 flame-arc lamps the cost is $5,785; for 250 tungsten lamps of 1500 cp. each it becomes $7,938. From the experience of the Barmen electric station it is stated that the cost of a 12-amp., 3000-cp. Dia arc lamp is $47.75, against $81.25 for a 3000-cp., half-watt tungsten lamp, and in a second case $38 for a 1500-cp. to 1800-cp., 8-amp. Dia lamp, against $45.25 for a 1500-cp., half-watt tungsten lamp. These examples show that even with relatively low prices for electrical energy modern flame-arc lamps are more economical than half-watt tungsten lamps.—*Elek. Zeit.*, June 3, 1915.

Generation, Transmission and Distribution

Storage of Coal.—G. G. BELL.—Storage of coal has become very important in Great Britain on account of miners' strikes, railway congestion, etc. At Hammersmith, where the author is borough electrical engineer, trouble has been experienced with the storage of large amounts of coal owing to overheating with the resulting danger of spontaneous combustion. A remedy has been found in storing the coal under water. The scheme of the Hammersmith Borough Council deals with a total of 7500 tons of coal stored in five separate tanks, each tank to contain only 1500 tons of coal. A single tank could not be used, as it was necessary to deal with three different classes of fuel, mechanical stokers not being yet fitted to all the boilers. Coal is delivered to the tanks by means of a pipe line, the coal and water being pumped in together and the surplus water being returned to the coal and water mixing tank at the riverside wharf. Three of the five tanks are maintained at maximum capacity and hold purely as coal reserves, only to be drawn upon in case of emergency. The remaining two tanks act as acceptance tanks and are used for receiving from the pipe line the new coal from day to day as it is delivered at the riverside wharf by barge. When the coal has been delivered into the tanks the level of the water in the acceptance tank is lowered to allow the water to drain off, and in twenty-four hours the coal will be sufficiently dry for use. The daily coal requirements are extracted by means of a grab worked by a jib crane, and naturally the latest deliveries will

always be nearest the top of the tank, and in this way the most recently mined coal will always be delivered to the furnaces in preference to older coal, and be consumed before it has time to lose any of its calorific value. The cost of such a scheme is necessarily heavy, as there is not only the capital expenditure on the tanks and coaling appliances, entailing heavy annual charges for interest and depreciation, but also the locking up of much working capital upon coal itself. In an ordinary business it is advisable to keep the working capital as liquid as possible and not lock it up in large permanent stocks of one article, but a statutory electric supply authority is in a different position and is almost compelled to maintain its supplies of energy so long as fuel is obtainable, without reference to the cost, whereas an ordinary trader is not under any such obligation. It is further thought that the scheme pays because manufacturers will make contracts with the station which they would not make if there was the slightest doubt as to continuity of supply. "The extra cost of a submerged storage scheme over a dry scheme is more than repaid by the maintenance of the calorific value of the coal. Coal stored in a dry state will lose as much as 10 per cent of its value in less than twelve months, and the loss increases year by year, but at a decreasing rate, whereas tests made with submerged coal show that there is practically no difference in the calorific value after nearly twelve months in the tank."—London *Electrician*, June 18, 1915.

Form of the Front Part of Traveling Waves.—LUDWIG BINDER.—The usual mathematical theory of the transient phenomena in a cable when it is suddenly connected to a source of electromotive force, gives the result that a traveling wave is formed with a straight perpendicular wave-front. This result is due to a certain assumption in the theory which is not realized in practice. The author first determined experimentally the form of the front part of the wave by measuring the voltage between two points of the same conductor at different distances. The voltage measurement was carried out by two entirely different methods, first by means of a spark-gap, illuminated by the radium or ultra-violet light, and second by means of a conductor, the voltage current being measured by a hot-wire instrument. The results of both measurements agree. The measurements show that the waves have not a straight vertical front since with a distance of 1 meter between the two points a potential difference of 12 per cent, and with a distance of 20 meters between the two points a potential difference of 70 per cent, of the total wave amplitude was measured. The measurements were made with 3000-volt currents.—*Elek. Zeit.*, May 20 and 27 and June 3, 1915.

Parallel Operation of Transformers.—R. H. WILLARD.—For single-phase transformers to operate satisfactorily in parallel it is necessary that they have the same ratio and the same regulation at all power-factors. It is desirable to use transformers of the same size for

FIGS. 1 AND 2—PARALLEL ARRANGEMENT OF TRANSFORMERS

parallel operation, but if they are not of the same size they can be paralleled if their regulation is the same; i.e., if the terminal voltages of both transformers at one-fourth, one-half, full load, etc., are equal. They will then divide the load properly regardless of their relative ratings. If two transformers of the same size, connected as in Fig. 1, do not share the load properly, they may be made to divide the load and operate satisfactorily by reconnecting as in Fig. 2, or if the transformers are separated by any considerable distance, the secondary sections of each transformer may be connected in parallel and the two transformers in series as shown in Fig. 3.—*Elec. Journal*, July, 1915.

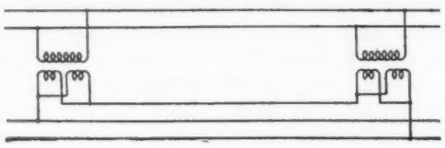


FIG. 3—PARALLEL ARRANGEMENT OF TRANSFORMERS

Protective Reactances.—A note on a recent British patent (No. 15,356, 1914) of J. S. Highfield and W. Duddell for a graded protective reactance coil in which the condenser action between adjacent turns is smaller at one end of the coil than at the other, and gradually increases from end to end, with the small condenser action connected to the line, and the other to the machine to be protected from surges. Arresters may be connected between points on the graded coil and earth.—London *Elec. Eng'ing*, June 17, 1915.

Traction

Use of Electric Vehicles in Municipal Service.—F. AYTON.—A report of the electric-vehicle committee of the (British) Municipal Electrical Association. The electric battery vehicle is eminently fitted for employment in practically all cases of municipal service, since the work to be done lies almost entirely within the proper sphere of this type of vehicle, namely, short-distance haulage at moderate speeds. The main reason for urging the adoption of electric vehicles by municipalities is the degree of economy which attends their use in substitution for horse haulage. Figures of cost are given for several stations. Notes are added on the use of electric vehicles for the collection of house refuse, ambulance work, fire-brigade work, and the general work of upkeep and cleaning of streets and roadways. There are now three municipal tramway undertakings in England making use of the electric-battery "bus" as an adjunct to their tramway services—Southbend-on-Sea, South Shields and York. In all three instances it is understood that the vehicles are giving satisfaction. An account of the discussion which followed is given in the same issue.—London *Electrician*, June 18, 1915.

Installations, Systems and Appliances

Electric-Heating Resistors.—LACH.—In the past two principal types of electric-heating resistor elements have

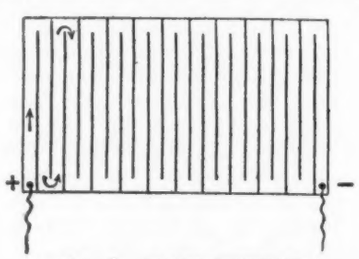


FIG. 4—PLATE RESISTOR

been introduced into practice, the first using a spiral wire wound on a cylinder in which the heat is to be produced, and the second making use of thin metallic films on insulating plates such as mica sheets. The author describes heating resistors produced by the Schoop "spray process." The metal which is to be sprayed

passes in form of a ribbon through a pistol in which it is melted and shot out in spray form onto the surface which is to receive the deposit. One method of application is to cover a plate of clay, porcelain, slate, etc., with a thin film of metal by the spray process and then saw cross lines out of the metal film as shown in Fig. 4. These lines start alternately from one side and from the other side, but do not pass all the way over to the other side. In this way a continuous zigzag ribbon is obtained, as shown in the illustration. The connections are made at the points + and —. Another method of application is to produce this resistor ribbon not on plates but on hollow cylinders, as shown in Fig. 5, where *a* is the ribbon and *b* represents the underlying clay tube. This resistor is particularly applicable for heating rooms. Through holes in the bottom cold air enters into the interior of the cylinder; it is heated inside the cylinder and rises upward so that fresh cold air is sucked in at the bottom. A third method of application is to produce metallic resistor ribbons in

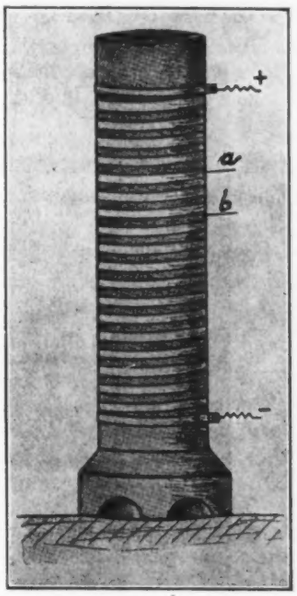


FIG. 5—SPIRAL RESISTOR

artistic forms directly on the tiles of bathrooms, kitchens and other rooms. If at any point such a ribbon resistor is not thick or broad enough, the deficiency can be easily remedied by the spray process.—*Elek. Zeit.*, June 3, 1915.

Indian Central Station.—An illustrated article on the new central station of Karachi, the most western of the four great ports of commerce in the Indian Empire, with a population of 160,000. This station uses a Diesel oil engine direct-current plant with a three-wire system of distribution at 2×200 volts. There are two 240-hp. and one 100-hp. units.—London *Electrician*, May 21, 1915.

Shunt-Regulating Resistors.—THOMAS CARTER.—Illustrated notes on shunt-regulating resistors. The author discusses three different subjects: first, potentiometer regulators; second, regulators with protective resistors; third, a special grading for ordinary regulators. The subject is treated rather fully and illustrated by tables and diagrams.—London *Elec. Review*, May 21, 28 and June 4, 1915.

Regulating Rheostats.—L. BOOTHMAN.—An illustrated article on the trend in design of modern regulating rheostats for electrical machine excitation control. The author refers to the defects frequently encountered in rheostats, and then describes a special form of rheostat manufactured by the British Westinghouse Company.—London *Electrician*, June 4, 1915.

Electron Currents from Hot Metals.—O. W. RICHARDSON.—A brief abstract of an experimental demonstration before the (British) Physical Society on "novel properties of the electron currents from hot metals." The first experiment demonstrated the cooling of a tungsten filament when an electron current is allowed to flow from its surface. This effect is analogous to the cooling due to latent heat when a liquid evaporates, or to the similar phenomena due to the heat of reaction when a gas is emitted by chemical decomposition of a solid. An experimental lamp containing a fine filament of double tungsten is placed in one arm of a balanced Wheatstone bridge actuated by the current which heats the wire. When the electron current is allowed to flow, by completing a side circuit from an electrode inside the lamp to a point in the adjacent arm of the bridge the galvanometer is deflected in a direction which corresponds to a reduction of the resistance (and temperature) of the hot filament. The second experiment, in which a similar experimental lamp is used, demonstrates the flow of electron currents from a hot filament to a surrounding cylinder against various opposing potential differences up to about 1 volt. On account of the large currents from tungsten this effect can easily be shown on a galvanometer. The data can be used to find the velocities of the emitted electrons.—London *Electrician*, June 11, 1915.

Units, Measurements and Instruments

Diagram of Three-Phase Transformer.—H. GEWECKE.—A communication from the testing laboratory of the meter and measuring transformer department of the Siemens-Schuckert Company. A diagram is developed for three-phase transformers similar to that for single-phase transformers, which can be plotted from no-load, short-circuit and resistance measurements, and enables one to determine the errors of the transformer which may occur at different loads, voltages and frequencies. An illustrated example is given which shows the application of the diagram. Finally a simple application of the diagram is described in which a transparent square-rule paper is used.—*Elek. Zeit.*, May 27, 1915.

Electromagnetic Vacuum Balance.—JOHN S. ANDERSON.—A long illustrated abstract of a Faraday Society paper. The chief aim in designing the balance was to be able, if possible, to weigh without removing it from the vacuum a substance whose weight may alter under certain conditions from time to time. One of the scale pans of an ordinary balance is replaced by a circular coil of wire whose axis is vertical. This coil is movable between two larger fixed coils of wire which have the same vertical axis. The three coils are so connected that an electrical current may be passed through them in series, through the movable coil and the lower fixed coil in one direction and through the upper fixed coil in the opposite direction. Thus, when an electrical current is passed through the coils, the movable one is attracted toward the lower and repulsed by the upper fixed coil. These attractive and repulsive forces may be increased or decreased by increasing or decreasing the current passing through the coils. They are made use of to counterbalance the force of gravity acting on the substance to be weighed in the scale pan hanging from the other end of the beam of the balance. Should the weight of the substance vary from time to time, the variations can be determined by altering the current passing through the coils until equality of the forces acting on either end of the balance is obtained. The balance is inclosed in a bell jar which can be evacuated, so that the substance is weighed in a vacuum.—London *Electrician*, June 11, 1915.

Book Reviews

PRACTICAL APPLIED MATHEMATICS. By Joseph W. L. Hale. New York: McGraw-Hill Book Company, Inc. 206 pages, 184 illus. Price, $1.

An excellent primer on applied arithmetic and elementary algebra. Many of the applications and illustrations are taken from the building trades and railroading. Incidentally much useful information is imparted concerning steam locomotives. The book is divided into twenty chapters, relating to the following subjects: Simple processes, common fractions, decimals, percentage, ratio and proportion, measurement of angles, mensuration of rectangles, mensuration of triangles, the circle, mensuration of simple solids, use of formulas, simple equations, the binomial, the use of tables and curves, cube root, mensuration of prisms, mensuration of miscellaneous solids, miscellaneous rules for polygons, miscellaneous rules for length area and volume, the metric system of measurement and tables. The book not only introduces the reader to the elements of applied algebra but also to the metric system. It is interesting to note how much of the teaching in the book could either be reduced or eliminated entirely if the metric system were in universal use. Several hundred problems are contained in the book which add considerably to its value in the hands of a teacher. The volume will recommend itself to artisans and mechanical workmen who desire to acquaint themselves with the elements of arithmetical applied mechanics.

DISTRICT HEATING. A Brief Exposition of the Development of District Heating and Its Position Among Public Utilities. By S. Morgan Bushnell and Fred. B. Orr, New York: Heating & Ventilating Magazine Company. 290 pages, 82 illus. Price, $3.

The opening chapter of this volume is largely historical and recounts the origin and development of district heating, and this is followed by chapters on methods of selling heat and systems of distributing steam and hot water. The five different methods of selling heat are treated at length, and typical contracts for these various forms of service, as well as a list of the meter rates for thirty-nine cities of the United States, add to the value of the chapter. The systems of distribution described include not only the piping, supports, conduits and insulation used in the streets but also the methods of arranging the piping within buildings. The different types of devices for metering hot water and steam are described in detail and rules are given for their care and maintenance. There is a brief survey of the boiler and furnace equipment of heating stations, followed by chapters giving formulas and data by which to estimate the steam required for heating buildings and for such miscellaneous purposes as running pumps, elevator engines, refrigerating machinery, laundry apparatus, etc., and for warming and cooking in restaurants. The concluding chapters deal with the relation between heat load and electric load, the use of heating data in making estimates, and the relation of heating to light and power in central stations. The authors have avoided the involved technical points, their object being to give the reader a general knowledge of district heating.

CENTRIFUGAL PUMPS. By R. L. Daugherty. New York: McGraw-Hill Book Company, Inc. 192 pages, 111 illus. Price, $2.

The rapidity with which the field of usefulness of the centrifugal pump has widened during recent years has been remarkable, and consequently a book devoted wholly to descriptions of this type of pump is timely. This particular work is very broad in its scope. The opening chapter deals with the classification of centrifugal pumps and the range of conditions under which they are used, and this chapter is followed by a second one describing the details of construction of different types, both single-stage and multi-stage. The book is not intended to treat of the problems of design of such pumps, but two chapters are given over to theory, in order that the reader may be able to understand the characteristics of various types and so determine their suitability for different services. It is written primarily for the use of the practising engineer who wishes to familiarize himself with the nature, types, efficiency, application, selection and management of centrifugal pumps; but the addition of numerous practical problems, together with chapters on testing, costs and elementary design, makes it equally well adapted for use as a textbook of instruction.

BOOK RECEIVED

Purchasing. By C. S. Rindsfoos, C.E. New York: McGraw-Hill Book Company, Inc. 166 pages. Price, $2.

RECENT TELEPHONE PATENTS

Message Counters

With message-rate systems of charging for telephone service there at times arises a demand for a message counter at the premises of the subscriber. A device for this purpose has been patented (No. 1,138,283) by Messrs. W. G. Dodge and C. H. Leave, both of Boston. The register is connected between one side of the subscriber's line and ground, and can be operated only when the hook switch is elevated. Except at such times no current can pass through the counter. Operation is effected from the central office by applying a sufficiently high voltage between ground and the proper side of the line.

Mr. Garrison Babcock of Rochester, N. Y., has also invented a message-counting device for use in telephone stations. This register is protected against unwarranted operation by short-circuiting the operating magnets until the telephone user desires a connection, and thereafter until a new call is initiated. The short-circuiting device is controlled by a polarized relay responsive to reversals of current in the line. The meter is set for operation by raising the switch hook. As soon as the called station answers the reversal of current in the polarized control relay advances the register one step. Mr. Babcock has also invented a combined call-counting and message-timing system. The latter records the number of time units consumed in conversation. With this system a station may listen in without recording, but the closing of the transmitter circuit causes a record to be made. Both of these patents (Nos. 1,138,174 and 1,138,175) are assigned to the Telechronometer Company.

Mr. A. D. T. Libly of Elyria, Ohio, has patented a combined police call and telephone system, his patent (No. 1,139,127) being assigned to the Garford Manufacturing Company. A three-wire line is used to which there are connected a number of stations. If the central operator depresses a certain key momentarily, lamps are lighted at all stations on the line, indicating that a patrolman is desired. As soon as one station responds all lights are extinguished and remain so. The central operator may extinguish the lights whenever she sees fit. A call-box mechanism and recording device are provided to transmit and receive periodic messages.

POWER AND OPERATING SECTION

Cooling Generating Apparatus

HEAT is a factor limiting the output of electrical apparatus, and various means have been devised to get rid of it. However, with the increase in the size of generating and translating apparatus, the operating problem of controlling temperature rise increases in complexity. It is not enough simply to force a large volume of air through windings without giving thought to the final destination of the heated air. This leads to overheated operating rooms and to disgruntled operators. Moreover, air which is apparently clean oftentimes contains enough dust and dirt to form a good non-conducting layer in recesses of windings where good radiation of heat is essential, and in not a few instances air has been known to contain oil and grease in suspension which admittedly are not advantageous attributes to insulation. By first washing the air with water two advantages are obtained—the air is precooled so that less of it is necessary to perform its proper function, and in addition it is filtered so that neither dust, oil nor other deleterious matter finds its way into the windings. Modern practice now dictates the discharge of the heated air outside of the building except at such seasons of the year and in such places as the air may be required for heating purposes. Considering the great increase of output possible from a machine robbed of its heat, it is surprising that cooling is not more generally employed. Even where increased output is not desirable, cooler operating rooms make such a scheme worth while.

From Spuds to Soda Ash

THE number and variety of substances that, in times past, have been introduced into steam boilers with the feed water would make an imposing and at the same time an amazing list, because they include such materials as molasses, potatoes, tanbark, kerosene and graphite, in addition to the numerous chemicals whose purpose is the precipitation of the impurities dissolved in or entrained by the feed water. The idea that such things as molasses, potatoes and tanbark can have any considerable action on feed water to render it less likely to cause incrustation or corrosion must appear chimerical to those engineers who have been accustomed to rely on chemicals of various kinds; for the amount of active elements that they contain must be small as compared with the amount of the substances used. Yet there are reports of satisfactory results obtained when these have been employed. The fact that such peculiar materials have been added to the contents of steam boilers emphasizes the desire and the effort on the part of engineers to combat the evil effects of scale in boilers, whether from the standpoint of economy or of greater safety of operation. However, modern methods make such efforts appear feeble and antiquated. By the aid of chemistry it is possible to analyze samples of the scale and of the water that produces it, and thus to determine the nature and the quantity of the reagents to be added for the purpose of neutralizing acids or converting scale-forming impurities into less troublesome compounds. The addition of potatoes or molasses indicates either sublime faith or profound ignorance; but the modern scientific method of attacking the scale problem goes directly to the root of the trouble and eliminates all the elements of hazard.

Lessons from Special Wiring

DEPARTURES from orthodox wiring arrangements often bring to light new and good engineering considerations for future plans. For example, in a large industrial plant, instead of placing the fuses for the various motor circuits near the motors and controllers at the various machine tools, these fuses were mounted on the under sides of roof trusses. A high-speed electric crane service made it possible to replace a fuse about as quickly as could have been done if it had been mounted on the floor. In this case the arrangement provided better clearance around the tools and columns of the shop, where long pieces of steel were swung constantly through the air and every inch of clearance around columns was important, not only to avoid injury to the fuses themselves but to expedite the handling of stock. Moreover, it was found possible in this plant to save on first cost by running feeder circuits in open cable from one roof truss to another and carrying the feeders to the different motors down the columns in iron conduit. This installation illustrates anew the possibilities of securing an adequate and economical wiring layout by paying extra attention to the mechanical problems of distribution.

N. E. L. A. Motor Service Rules

IN this issue appears a tabulation of the permissible starting current values for a single motor installed and connected to its load as proposed by the electrical-apparatus committee of the National Electric Light Association in its recent report. While this attempt at standardizing the service requirements for motors will work its greatest benefit in favor of motor manufacturers in permitting them to carry a larger stock of certain designs of motors called for by similar operating conditions in all localities, the standardization has as well operating advantages both to the central station and to its customers. In the first place, it would

make possible the securing of motors suited to particular starting conditions such as voltage regulation and safety in starting, for if the designers of motors live up to the starting restrictions and the motors are installed according to the service rules, there will be little occasion for service complaints due to flickering of lights when small motors are operated on lighting circuits.

The proposed rules governing the instantaneous current to be drawn from the line by a motor are based upon amperes per horsepower instead of a multiple of full-load current, so that the starting currents are in proportion to the various sizes of motors. Instead of an allowable two and one-half times full load current up to 20-hp. sizes, for instance, as in some cases heretofore, which was a severe allowance for motors below 5 hp. and too liberal for those above, the allowable starting current is plainly specified, and there need be no guesswork or blanket specification covering the allowable rating, with a resulting poor and unsatisfactory service from small motors used on intermittent work.

Since the work of the committee has every indication of being an important and beneficial one, and the coming year has been allowed for "trying out" these service rules, it is important that all operating companies investigate their merits by temporary adoption, that their practical features may be proved. If the results are found in accordance with expectations and the rules are adopted by the association one year hence, they will probably be considered and incorporated in some form in the National Electrical Code and thus generally enforced.

Boiler Explosions

In view of the fact that about 1400 serious boiler accidents occur in the United States each year, resulting in injury or death to about 1400 persons and a loss of about half a million dollars' worth of property, it is important that every steam-plant operator should understand the causes of explosions and take all precautions to prevent them. In a steam boiler the temperature of the water is about the same as the temperature of the steam in contact with it. When the steam openings to the boiler are closed and the fire drawn the boiling action ceases, but if a valve in the steam main is opened, even with the fire drawn, the boiling action will start again. It is the pressure on the surface of the water that prevents the generation of steam when the steam openings are closed.

If a small rupture takes place below the water line, an explosion may not result. On the other hand, if a large opening is suddenly made above the water line, as when a steam pipe fails, the sudden liberation of the pressure on the surface of the water at high temperature will allow it to flash into steam and cause a violent explosion and water hammer capable of disrupting the strength of the best boiler construction.

According to the experience of a well-known casualty insurance company, it is in this manner that the most violent boiler explosions are produced. The violence is incomprehensible to the layman and boiler-room attendant who has never observed the results of an explosion, and frequently the opinion is held that some action at high pressures, like that of dynamite instead of steam, causes the disaster. There is, of course, no basis for such an opinion. A cubic foot of heated water under a pressure of 70 lb. contains about as much stored energy as a pound of gunpowder, and, according to estimates, the heated water in an ordinary cylindrical boiler contains enough energy to project the boiler vertically into the air without obstruction to a height of about two miles.

Saving Money in Standby Plants

Auxiliary steam plants designed for service in connection with hydroelectric stations offer attractive opportunities for saving money in cases where the percentage of operating time is small in relation to the yearly cycle of outputs. Anything which will reduce the investment required to handle a peak load or to tide over a low-water period of moderate duration deserves very careful engineering consideration. In many auxiliary steam plants the installation is made to supplement existing water-power stations while the load is growing, so that ultimately the coal-burning or oil-burning plants become of major importance in the expansion of generating facilities. Where the possible hydroelectric development is rather limited, it then becomes necessary to design the auxiliary or standby station with a view to ultimate operation at very high efficiency.

In a representative case of this kind the flexibility sure to be demanded in the future is provided for by increasing the size of the building beyond the initial needs and seeing to it that the structure has sufficient strength to carry the ultimate mechanical load. The additional cost of a building adequate in size and structural members to include future coal storage and a motor-driven conveyor system is small. Where the saving comes is in omitting overhead coal bunkers and in getting along for the time being with manual firing of fuel into furnaces or stokers, besides manually disposing of ashes. It may seem heretical to depend on muscle for such work, but there are ample precedents for doing so. The stoker question must be decided on its merits, but, generally speaking, mechanical stokers are a godsend in a standby plant, no matter what may be the means of putting fuel upon hopper or grate.

In a standby plant for limited use, a hand-operated crane is obviously worth serious consideration, as is the possibility of getting along with cheaper grades of pipe covering, or at least with thinner coatings. Hand-operated valves will be the accepted practice, and the arrangement of condensing equipment to save first cost deserves careful study. By these and similar methods the initial outlay for a standby plant may be reduced by a good percentage below the cost of what might be called a multiple-unit station, complete in sectionalized detail, but embodying a flexibility and consequent investment not justified under the conditions.

The Power Plant of the New Equitable Building

Steam Generating Equipment, Water Supply and Heating, Ventilating and Electrical Features of New York's Mammoth Office Building

THE task which confronted the designers of the new Equitable Building in New York City was that of planning an office building of such a height as to produce the greatest return in proportion to the investment made. The problem resolved itself into that of determining the maximum economical height for an office building to cover the city block bounded by Broadway, Nassau, Cedar and Pine streets, a lot situated at the center of New York's most expensive land district. After a most thorough and careful study of the problems presented, plans for the elevator installation of a forty-story building were made. These plans determined the height of the building, which finally called for thirty-eight stories and a two-story, 50-ft.-high penthouse, making the total height 555 ft. from the sidewalk to the roof of the penthouse. A basement, a sub-basement and a sub-sub-basement make up the underground portion of the building.

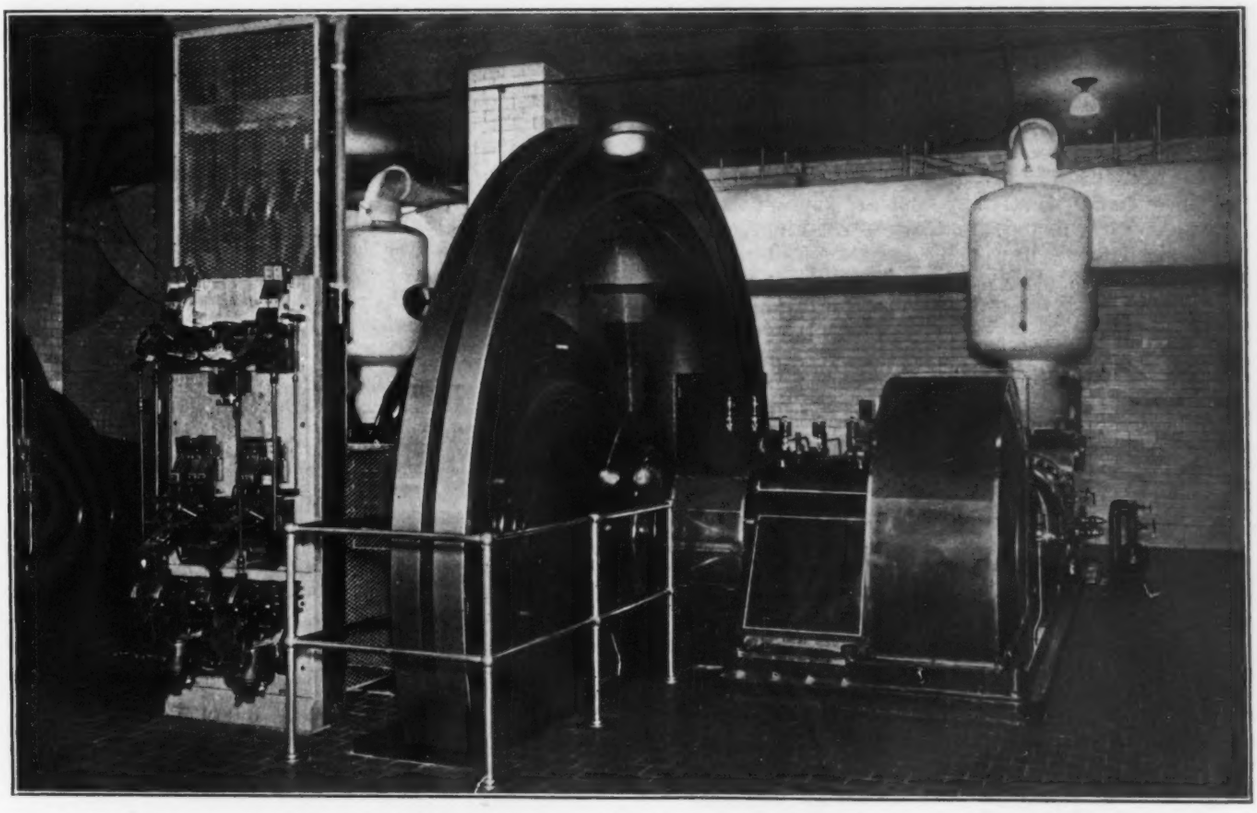
Up to the seventh story the building is solid, but beyond this height there are two large light courts open to the street at the two ends, giving the upper part of the building the form of the letter "H."

One of the most difficult problems encountered in the construction of the building was the securing of a suitable foundation. By going down 80 ft. below the curb bedrock was reached, and on this a cofferdam was constructed which incloses the foundation, covering 49,000 sq. ft. This cofferdam has numerous caissons and is of solid concrete reinforced by heavy steel rods, its perimeter being 930 ft., its vertical height 80 ft., and its width 6 ft. There is also a retaining wall extending from Cedar to Pine Street, built to eliminate excavation under the space occupied by the vaults and safety-deposit department in the sub-basement.

The building is of granite and brick construction with terra-cotta ornaments. The entire construction is notable for the precautions taken to guard against fire, and the building now stands as an example of what is considered the best fire-resistive construction in existence. Additional protection against fire was obtained by constructing the building with fire walls which divide it into four fire units, communication between them being provided by means of special steel and asbestos fire doors so constructed that they will not buckle under the most severe conditions that can possibly exist in case of fire. The value of the building is placed at $15,000,000 and that of the land at $14,000,000. The cubical content of the building is 26,000,000 cu. ft. and the rentable area 1,200,000 sq. ft. It is estimated that the resident population of the building will be about 12,000 and that there will be a total resident and floating population of about 50,000.

The Steam Plant

A steam plant is installed in the sub-sub-basement of the building and furnishes energy for its electrical equipment, for heating, water supply, ventilation and other purposes. Coal is purchased in boatloads, hauled



ONE OF SIX ENGINE-DRIVEN GENERATING UNITS, SHOWING CIRCUIT-BREAKER PANEL AND SWITCHBOARD LEADS

to the plant in wagons, and dumped in a three-part coal bunker that holds 2000 tons or a forty-five days' supply. The middle compartment of this bunker is for soft coal and the outer two compartments for hard coal, a mixture of six parts of anthracite No. 3 and one of soft coal being used in the boilers. The soft-coal bunker is equipped with a coal valve and chute, while the hard-coal bunkers are equipped with chutes only. By means of these valves and chutes the coal is passed into 1-ton side-pocket hand cars which run on tracks terminating in front of and laid parallel to the rows of boilers, which are hand-fired from the cars. Two coal scales are provided in the boiler room for weighing the coal brought in by the cars.

The boilers are provided with dumping grates and the ashes removed by side-discharge, sloping-bottom ash cars equipped with flexible chutes. These cars are carried above the street level by means of an elevator capable of accommodating two cars at one time. The ashes are then discharged directly into a wagon by means of the flexible chutes.

The boiler equipment consists of seven Heine water-tube boilers, five of which are of 440-hp. rating and two of 539-hp. rating, constituting one battery. Each boiler is equipped with a Blonck boiler efficiency meter. The boiler drumheads are covered with 2-in. 85 per cent magnesia blocks and finished with a ½-in. thickness of cement. No forced draft or superheating of the steam is employed.

Feed-Water Supply

Water for the boilers and for house and fire purposes is obtained by means of four 6-in. mains, each of which is connected to one of the four street mains on the four sides of the building. The water thus obtained is carried to a header, filtered through five Loomis-Manning filters, and carried to two surge tanks of 17,000 gal. capacity each. These tanks are so piped that not more than two-thirds of their capacity can be used for boiler-room and house purposes, the remaining one-third of the capacity of each tank being reserved for fire purposes. In case of emergency the filters can be cut out of the system by means of a by-pass for water around them. Also in case of emergency, water for the boilers can be taken from a high-pressure house tank on the fortieth floor of the building, giving a pressure at the boilers of 285 lb.

The steam-driven feed pumps are at the north end of the boiler room and are of the Worthington outside-packed plunger type, having a stroke of 10 in. by 18 in. Cochrane open-feed water heaters with V-notch recorders, giving the rate of flow in pounds per hour and the total flow for twenty-four hours, are used. The average flow is 100,000 lb. of water per hour. Two separate feed-water lines covered with two layers of wool felt are employed, either one capable of furnishing the entire water required for boiler purposes. One line is of brass and the other of galvanized iron, lead-lined.

Steam Piping and Engine Equipment

Steam from the boilers is carried to a 20-in. header equipped with steel-welded flanges and installed directly back of the boilers on the floor level, so that division valves can be operated conveniently when standing on the floor. The division valves are so arranged that the boiler and engine equipment can be divided into four sections. Two boilers are connected to each of three of the sections, while one boiler is connected to the remaining section. All live-steam piping is overhead and insulated with 1½-in. 85 per cent magnesia coverings. Fittings and flanges in the insulating coverings are made removable in order to permit of ready access to bolts in case of repairs, etc. A canvas jacket sewed on and painted is placed over the insulation mentioned.

Six Rice & Sargent Corliss reciprocating engines are installed, each equipped with a Cochrane steam separator and directly connected to a direct-current 240-volt General Electric generator. The engines take steam at about 150 lb. pressure from the overhead piping. Three of these engines are each rated at 900 hp., 100 r.p.m., and have 26-in. diameter cylinders and 48-in. stroke. Two engines are rated at 450 hp. and 110 r.p.m., with a cylinder diameter of 20 in. and a stroke of 42 in. The sixth engine has a 300-hp., 110-r.p.m. rating, with a cylinder 16 in. in diamter and a stroke of 42 in. Steam is delivered to the 900-hp. and the 450-hp. engines by means of separate steam mains connected to different sections of the 20-in. steam header, while steam for the 300-hp. engine is taken from a branch main each end of which is connected to a steam-circulating main passing along the north and south sides of the engine room. The branch steam main has division valves at its ends, thereby permitting the two engine units connected to it to be shut down without affecting the other apparatus connected to the circulating main. The main exhaust piping from the engines and pumps is connected to a large expansion tank of the utility separator type installed in the sub-sub-basement. From this tank the main heating and exhaust riser is taken, together with connections for hot-water and feed-water heating.

The drips for the system are divided into two classes, clean and dirty. Both clean and dirty dips are connected to a drip pit containing suitable tanks and pumps. There are three pumps, one to take care of the clean drip water, one for the dirty drip water, and one spare pump so connected that it may be used for either purpose. The clean drips are returned to the feed-water heater and the dirty drips discharged into the sewer. Steam traps of the Brown type are installed on each engine and pump, besides two to take care of each section of the main steam header. Four lifting traps are used, two in the drip pits and two at the oil separator of the feed-water heater.

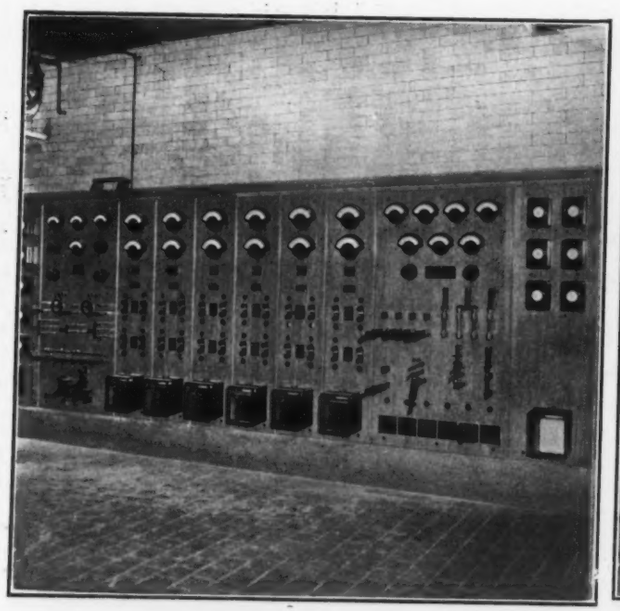
Oiling System

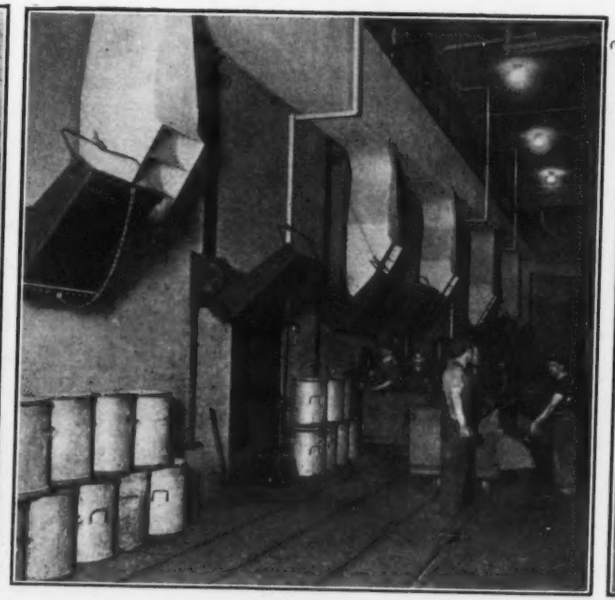
Cylinder and engine oil is furnished the engines by means of the Bowser gravity system of oiling. Three pumps are installed for this purpose, each being equipped with a direct-connected 0.5-hp. motor. The main gravity tanks are situated on the ceiling of the sub-basement above the engine room. The motors supplying these tanks are float-controlled. The system has a capacity of 700 gal. of engine oil and 400 gal. of cylinder oil. Each engine is equipped with a Richardson-Phenox self-oiling system.

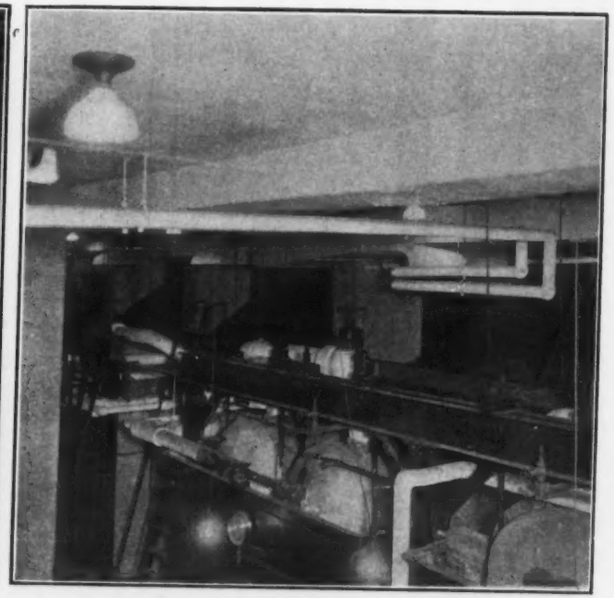
Steam Pumps for House-Water Supply

The steam-circulating main, previously mentioned as a means for furnishing steam to two engine units, is connected at each end of the 20-in. header and passes through the engine room and around the pump room. Division valves are so arranged at numerous points as to enable certain equipment to be shut down in case of emergency without affecting any other machines. In the pump room are two steam pumps for water supply at each of the three house levels. At each of these levels, which are the seventeenth, twenty-seventh and fortieth floors, there are two house tanks. On the fortieth floor two of 12,500-gal. capacity are installed, on the twenty-seventh floor two of 10,000-gal. capacity, and on the seventeenth floor two of 10,000-gal. capacity.

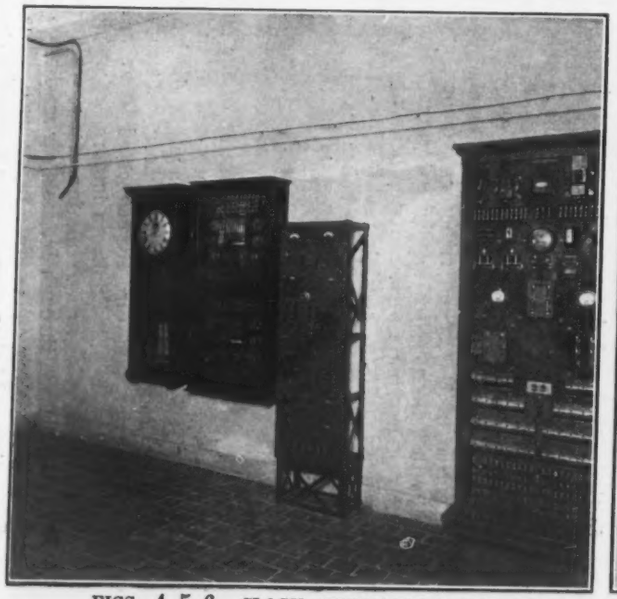
One of the pumps for each level is connected to the north side of the circulating main and the other to the south side, division valves being so arranged as to crip-

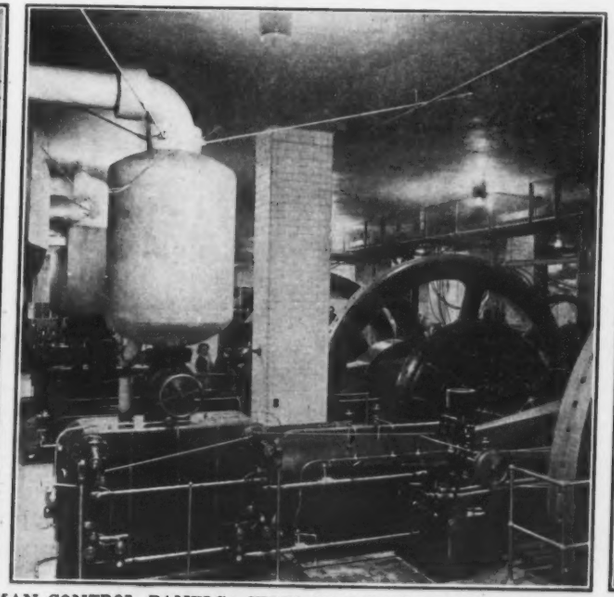


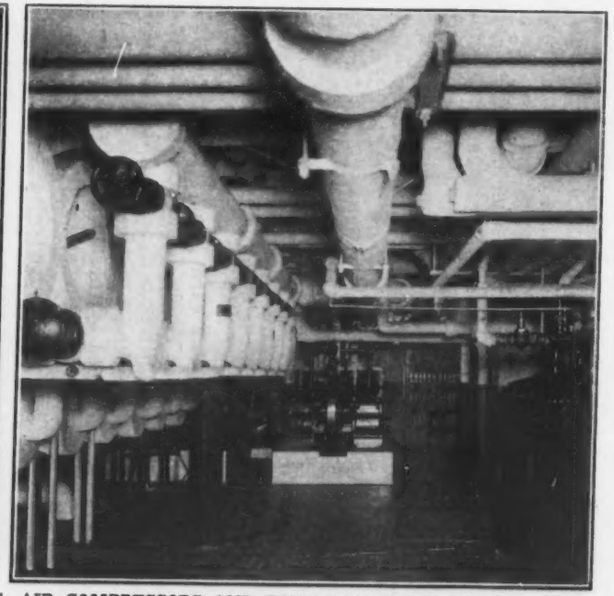




FIGS. 1–2–3—CONTROL SWITCHBOARD; COAL CHUTES AND BOILER-ROOM VENTILATING DUCTS; LIGHTING AND VENTILATION OVER BOILERS







FIGS. 4–5–6—CLOCK, FIRE-ALARM AND WATCHMAN-CONTROL PANELS; VIEW OF ENGINE ROOM; HEATERS, AIR COMPRESSORS AND TANKS IN PUMP ROOM

ple only one pump in case a section must be shut down for any reason. Two fire pumps are installed on the north side of the circulating mains with division valves also provided. In the pump room are also air compressors, hot-water heaters, ice machines, etc., all being so arranged that division valves prevent the operation of the entire equipment being crippled at the same time. Two Blaisdell air compressors for cleaning and for sewage ejectors are also installed. These operate at three different pressures, the pressure being controlled by reducing valves at the tanks. All tanks, heaters, separators, etc., are insulated with 1½-in., 85 per cent magnesia blocks placed over a 1-in. air space. Over these blocks a canvas jacket is sewed and painted.

The hot water for the building is obtained from hot-water generators and storage tanks, there being two heaters and tanks for each level. The water supply below the first floor is obtained from street pressure. The heaters are so cross-connected that the intermediate level can be used on the high level, and vice versa. The heaters are controlled by thermostats. Two Carbondale 50-ton ice machines of the absorption type with high and low pressure brine circulation are also installed in the pump room. Brine is circulated in the club, restaurants, café and barber shop, but no circulating ice water is provided. The ice machines have a capacity of 20 tons of ice per day and a storage capacity of 20 tons.

Building Heating

The Webster system of direct and indirect heating is employed. This system utilizes the exhaust steam from engines, pumps, etc., with provision for supplementing the exhaust steam with live steam under reduced pressure when the exhaust steam is not sufficient. Three steam-driven vacuum pumps are so connected that any one pump can be used for either the direct or indirect system or both. The indirect heating is accomplished by means of stacks and ducts, while the direct heating is accomplished by means of radiators.

A pipe shaft 12 ft. square leads from the sub-sub-basement to the penthouse and contains all water pipes, steam pipes, brine-circulating pipes, heating risers, etc., up to the fortieth floor. A back-pressure valve is installed on the 30-in. exhaust riser at the thirty-seventh floor. A 24-in. heating main is taken out at the thirty-sixth floor, branching off to heating mains which encircle the building near the building wall. All heating risers are taken off from this circulating main and lead up to the fortieth floor and down to the second floor. The radiators are connected to these risers by concealed branches under the floor. In general, heat is obtained by three systems of piping, downward, overhead, and underneath the system feeding the first floor.

All heating lines above the sub-sub-basement, with the exception of risers and radiator branches, are insulated with 1-in. asbestos molded coverings. For the insulation of heating risers, radiator branches and expansion loops, 0.75-in. special wool-felt coverings are used. This insulation, as well as boiler, pump, steam-line, feed-water-line, etc., insulation, is of the H. W. Johns-Manville type.

Ventilating System

The fresh air for the general ventilation of the building is obtained at the seventh, eighth and ninth-floor levels above the court, and the exhaust is discharged through the roof of the fortieth floor. Twenty-six American blower fans directly connected to an aggregate of 300 hp. of Allis-Chalmers motors are employed for causing the necessary circulation of air. All fresh air supply is passed through Iroquois air washers, tempering and reheating coils before being used. The air for the engine and boiler rooms passes through a cheese-cloth filter. All fresh-air ducts are covered with air-cell sheets, and finished with a heavy sewed canvas covering. The accompanying illustrations show the arrangement of ventilating ducts in the engine and boiler rooms.

Automatic Sprinkler Systems

In addition to the general fireproof nature of the building, automatic sprinklers are installed in such portions of the building as required by the New York Fire Insurance Exchange and New York Board of Fire Underwriters. The supply of water for the sprinkler systems is obtained from several sources, one of which consists of two separate 4-in. mains connected to different street mains. For the third intermediate floor water is obtained from two steel pressure tanks of 7500-gal. capacity equipped with gage-glass and shut-off valves. The 5000-gal. vertical steel tank on the thirty-eighth floor is used to supply water to the thirty-sixth-floor sprinkler systems. A standard Siamese steamer connection is installed on the sidewalk and connected with the two sprinkler systems. A Siamese hose connection is also installed on the roof of the thirty-eighth floor. Compressed air is obtained from two sources. Two Blaisdell air compressors and two Westinghouse locomotive-type compressors are installed in the sub-sub-basement.

An electric sprinkler-alarm system is also installed, the indications being received on a board in the chief engineer's office, where the fire-alarm, electric-clock and gage boards are also installed.

Elevator for Lifting Office Safes

All safes delivered to the building are handled by means of a sidewalk-type plunger elevator, which delivers them to sub-basement freight vestibules, where they are transferred to an electrically operated elevator for delivery to the tenant. A separate hydraulic pumping plant is provided for the elevator, jack pumps being installed for use when handling heavy safes.

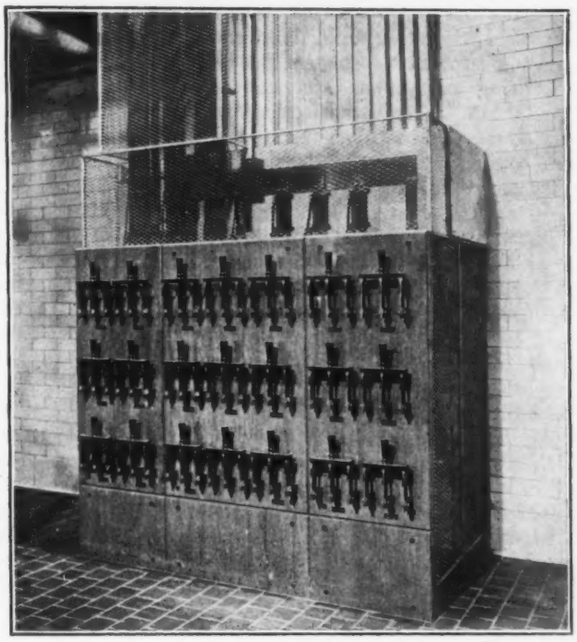
Generator Switchboard and Electrical Equipment

Six generators, all of the General Electric inter-pole compound-wound type, having a voltage rating of 240, are each connected to one of the six engines in the engine room. Three of these generators are rated at 600 kw., two at 300 kw. and one at 200 kw. Two hundred and forty volts is used for motor service throughout the building, and 120 volts for lighting purposes. The necessary voltage for lighting purposes is obtained by means of a three-wire system and two 200-amp. balancer sets in the engine room.

All of the electrical equipment in the engine room is remotely controlled from a ten-panel switchboard, a remotely controlled circuit-breaker being installed on a marble panel near each generator for controlling the corresponding circuit. The control circuits for the generating units are run in conduit along the ceiling. All main generator connections are made by means of copper bars, carried vertically from the generators to near the ceiling, and then carried horizontally by means of special channel-iron hangers equipped with insulators and supported from the ceiling of the engine room. All of these conductors are inclosed in wire-grating frames, preventing accidental contact and short-circuits from material falling upon them.

The main switchboard, which is of the remote-control type, consists of ten marble panels. One of these is for the elevator circuits; one is for duplicate motor-generator sets for changing two sets of 24-volt storage batteries that are used for annunciators, fire alarms, clocks and other purposes about the building, and there are six generator panels, one for each generator, one balancer

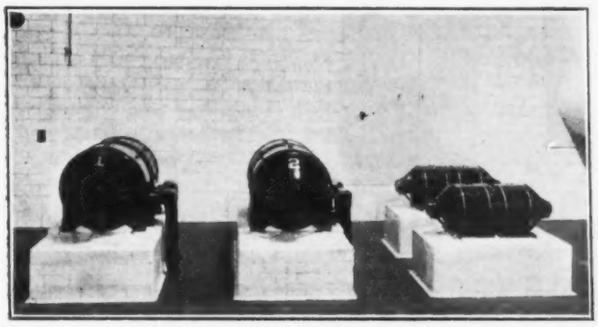
panel, and one totalizing panel. The switchboard is supported on an angle-iron frame, and the current-carrying parts are inclosed by a brass grating. Conduits are carried horizontally to the top of the board from a pull box installed flush with the wall to the back of the board. This pull box is provided with sectional



ONE OF THE FOUR DISTRIBUTION BOARDS FOR BUILDING-LIGHTING SERVICE

doors to permit of ready access. Between the board and the pull box General Electric motor-operated field rheostats are installed for the six generators. No distribution panels are included on the main switchboard, since panels are placed near the four corners of the building for this purpose. One of these distribution panels is shown in the above illustration.

The electrical equipment of the building is so arranged that practically four isolated distribution systems are installed, rendering each vertical quarter of the building independent of all others. Four wire shafts, one



BALANCER SETS FOR BUILDING LIGHTING AND TWO MOTOR-GENERATOR SETS FOR LOW-TENSION SYSTEM

near each corner of the building, are employed, each shaft supplying one-fourth of each floor.

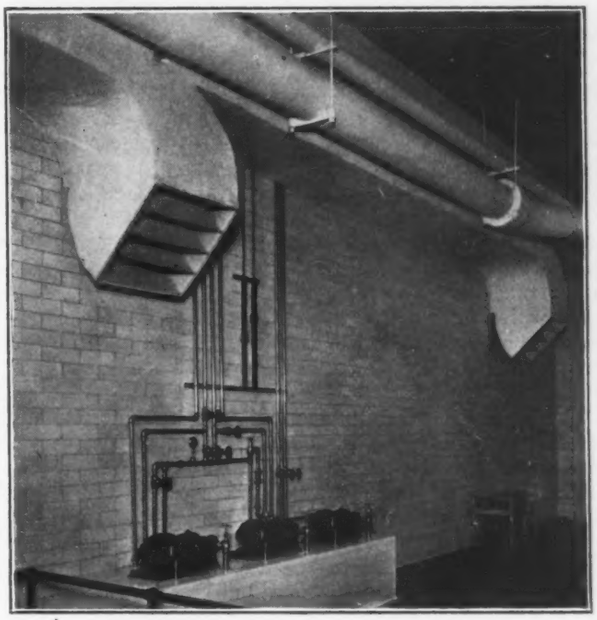
Use of Electric Energy During Construction

In making the excavation necessary for the Equitable Building, the O'Rourke Engineering & Construction Company contracted with the New York Edison Company for about 1500 hp. of electric energy to be used during the construction period. Two large air compressors, one of 140 hp., the other of 160 hp., were employed to compress the air in building the caissons. Twelve large motors and numerous smaller motors were used for hoisting. A total of 880,523 kw.-hr. of electrical energy was consumed during the process of excavation.

During construction of the building about 1500 hp. was also employed in motor applications, and about 600 incandescent lamps and ten arc lamps were necessary for illumination purposes. During construction about 401,384 kw.-hr. of electrical energy was used by these motors and the lighting equipment.

Design and Construction of Building

It is interesting to note that plans for the new Equitable Building were conceived long before the date of the fire that destroyed the old building on Jan. 15, 1912. In 1905 D. H. Burnham & Company, architects of Chicago, made original designs for a sixty-two story building for the Equitable Life Assurance Society. These plans were held without action until the early part of 1912, when the property was purchased by General T.



PUMPS AND CONTROL OF THE ENGINE-ROOM OILING SYSTEM

Coleman du Pont, president of the Equitable Office Building Corporation, which manages and operates the building.

New plans were then prepared by Mr. E. R. Graham, architect of Chicago, for the present Equitable Building and the mechanical equipment, under the direction of Messrs. J. R. Furnam and G. W. Hubbard, the architect's engineers. These plans were then approved by the owners, and a contract was made with the Thompson-Starrett Company of New York City. Detail plans and working drawings were then prepared for the entire mechanical equipment, under the direction of the architect's engineering staff and Mr. R. D. Ward, as mechanical engineer, representing the owners. Mr. C. E. Knox was retained by the owners as consulting engineer on the elevators, and Mr. Henry C. Meyer by the Equitable Life Assurance Society as consulting engineer for the mechanical equipment. The engineering staff of the contractor's mechanical department consisted of Messrs. William Gordon, W. H. Driscoll, Otto Dimmert, John McMillan, S. S. Schaeffer and William P. Cook, Jr.

Converting a Distribution System

Methods of Effecting Change from Two-Phase to Three-Phase on Richmond Light & Railroad Company's Lines Without Interrupting Service

THE distribution system of the Richmond Light & Railroad Company, New Brighton, N. Y., serving all Staten Island, has been converted from 2300 volts, two-phase, sixty cycles, to 2300 volts and 6600 volts, three-phase, sixty cycles, without interrupting the service. The old arc lamps and carbon filament lamps used for street illumination have been replaced by 100-cp and 250-cp, 6.6-amp series gas-filled lamps. A new substation has been built at Concord which receives 6600-volt energy from the Livingston power station and converts it into energy for operating the street-car systems in the Concord, New Dorp, Richmond, South Beach and Midland sections of Staten Island. A number of changes have also been made at the Livingston power station, where the energy for the entire system is generated.

Former Conditions

In addition to a 600-volt direct-current system for railway operation, which was retained, the former layout consisted of a number of two-phase, three-wire, 2300-volt transmission lines for light and power service and a few two-phase, four-wire lines for the same purpose. The power plant contains three direct-current 600-volt generators having a combined rating of 1600 kw and four two-phase, sixty-cycle, 2500-volt alternators having a combined rating of 6500 kva. Within the next two months a 7500-kva, three-phase, sixty-cycle, 2300-volt turbine-driven alternator will be added to the existing equipment. This will be used to take care of the additional load expected and that due to the new substation.

The methods used to rehabilitate the power plant and the entire system embody the ideas of Mr. C. W. Hotchkiss, the president of the company, and Mr. W. H. Rudisill, its chief engineer, as worked out in the latter part of the year 1914, when it was decided that a change from two-phase to three-phase at the voltages mentioned would be desirable, because of the more efficient transmission that would be obtained and the desirability of using three-phase motors for power applications. Further, the capacity of the existing lines has been increased by the change-over so that they will take care of part of future loads.

All motors installed since October, 1914, have been of the three-phase type to eliminate the necessity for reconnection and changing the control equipment when three-phase service was established. It was necessary in many cases, therefore, to supply 220-volt, two-phase, three-wire service, 220-volt, three-wire, three-phase service and 110-volt, three-phase, three-wire service from the existing two-phase, three-wire or four-wire transmission lines then employed, until such a time as the transmission lines were changed to three-phase operation. In such cases use was made of the scheme of connections shown in Fig. 1. The transformers shown were of the out-door type mounted at necessary points along the transmission line so that they could be easily removed as soon as the changes to three-phase, 6600 volts or 2300 volts, were completed.

Methods Used in Changing from Two-Phase to Three-Phase Service

In changing from two-phase to three-phase a switchboard having two sets of buses was used. Two 800-kva transformer banks were installed at the main power station at Livingston, one temporarily T-connected and designed to take two-phase, 2300-volt energy from the generating equipment and convert it into 6600-volt, three-phase. The other transformer bank was open-delta connected and used for straight three-phase operation, converting from 2300-volt, three-phase, to 6600-volt, three-phase.

During the change-over period one set of buses on the main switchboard was designated as the two-phase bus and the other as the three-phase bus. Two 500-kva and one 1600-kva, 2300-volt alternators were reconnected for three-phase generation and connected to the three-phase buses. A 3000-kva, 2300-volt generator was retained for two-phase operation and connected to the two-phase bus.

The first step taken in the change-over was to furnish three-phase energy to the new Concord substation, to which a three-phase line had already been constructed and at which place three-phase apparatus had been installed. This meant a load of about 500 kva, and an additional load of 300 kva was added by reconnecting the motors used in connection with the Livingston station for three-phase operation. All of this three-phase apparatus was then supplied with energy from the three-phase bus.

Use of Open-Delta-Connected Transformers

The distribution systems for lighting and motor service were retained two-phase. Open-delta-connected transformers were installed for the various motor users, with the transformers plugged so as still to give the correct

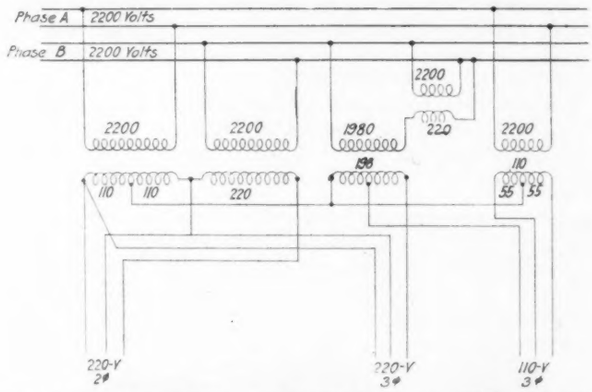


FIG. 1—TRANSFORMER ARRANGEMENT FOR 220 AND 110 VOLTS, THREE-PHASE, AND 220 VOLTS, TWO-PHASE SERVICE

voltages for straight two-phase transformation. This work was done on Sundays and at other times when the motors were out of service. When all the motors corresponding to the open-delta-connected service transformers installed were reconnected, the transmission line was connected to the three-phase bus at the Livingston power station and the plugs of the open-delta-connected service transformers were removed so as to give correct three-phase voltages for the motors. An entire motor installation of 400 kva to 500 kva was changed over on one Sunday and made ready for three-phase operation the next day.

Where a circuit was too long to be changed at one time, only about 400 kva or 500 kva, corresponding to

the part of the line nearest the power plant, could be changed to three-phase. In such cases it was necessary to provide two-phase energy from the end of the section corresponding to the first 400 kva or 500 kva connected for three-phase operation. This was done by inserting at such points transformers connected as shown in Fig. 2, thus giving two-phase service along the remainder of

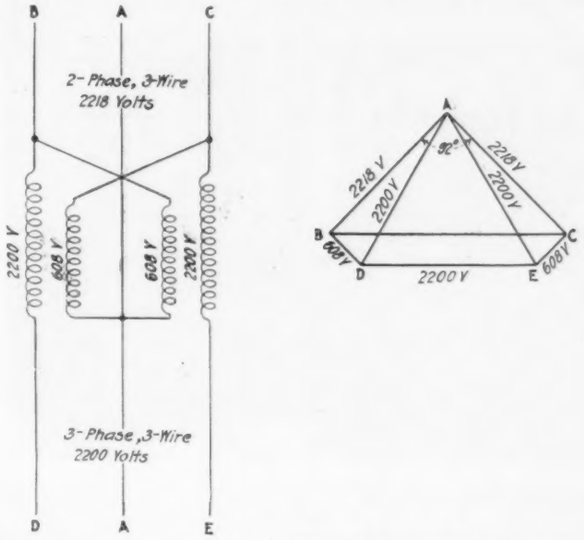


FIG. 2—METHOD OF CHANGING FROM THREE-PHASE TO TWO-PHASE

a line. The transformers employed were standard General Electric 2200/608-volt transformers, and the scheme of connection employed was developed by Mr. L. G. Smith, assistant electrical engineer of the company. The phase relation obtained on the two-phase side of the transformers was approximately 92 deg. The two-phase and three-phase voltages were essentially the same. Transformation from 6600 volts to 2300 volts was obtained where necessary by means of transformer banks installed on the ground and inclosed by wire netting.

The process of installing the open-delta-connected service transformers and reconnecting the corresponding motors for three-phase operation was continued, and the length of line furnishing three-phase energy was gradually increased by changing the position of the transformer arrangement shown in Fig. 2 until the end of a line was reached. This process was employed on all power-transmission lines. In the meantime the street lighting circuits were reconnected for three-phase operation.

When the entire distribution system was changed for three-phase operation, which was about May 30, the T-connected transformer bank at the main power station was finally arranged to supply three-phase energy.

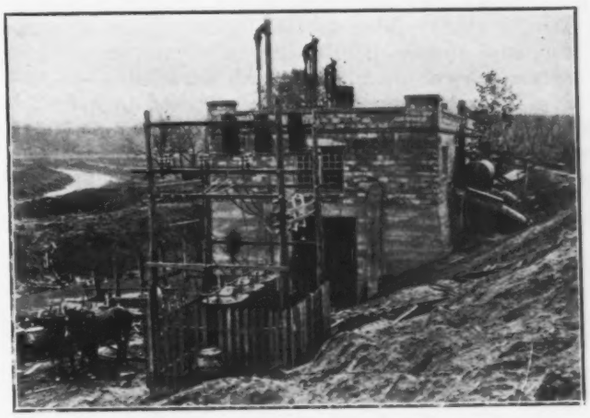
Electricity Replaces Steam in Drainage Pumping

Spring Lake Drainage & Levee District, which owns about 12,000 acres of reclaimed land along the Illinois River in Tazewell County, Illinois, is now operating its 500-hp. pumping station with electricity from the lines of the Canton (Ill.) Gas & Electric Company. For three or four years this district, which is one of the largest on the Illinois River, has been operating a steam pumping station, but this plant has now been shut down. It is expected that the electrical installation will save the district a considerable sum on pumping costs and that it will eliminate troubles which have arisen from lack of coal and from machinery breakages.

The plant contains two 300-hp., three-phase, 440-volt, 575-r.p.m. Westinghouse motors, connected by silent-chain drives to two 48-in. double-suction centrifugal pumps, and one 100-hp. motor, similar in characteristics to the larger units, driving a 24-in. centrifugal pump. Varying pump speeds for working against different heads of water are obtained by changing the gears which engage the silent chains. When operating at maximum rating the 48-in. pumps are capable of delivering approximately 70,000 gal. of water a minute.

Energy for operating the station is delivered from Canton, 16 miles distant, over a three-phase, 13,000-volt line. This transmission potential is reduced to 440 volts in an outdoor substation equipped with three 200-kva. Maloney transformers protected by Westinghouse low-equivalent lightning arresters and Burke disconnecting switches.

The land being drained lies in a 15-mile strip along the river. The flowage this spring has been handled by operating one 300-hp. motor eight hours a day and



PUMPING STATION, SHOWING TRANSFORMERS IN FOREGROUND

the 100-hp. motor sixteen hours a day. One large motor, it has been planned, is to be held in reserve to meet emergencies and to be used in time of high water.

Ultimately more load will be added to the transmission line, as the Banner Special Drainage & Levee District with 3500 acres of land expects to begin operating an electrically driven station in the fall. Other districts are being formed along the Illinois River, and the Canton company expects to supply energy to several of these in its territory.

Theory of Induction Meter Operation

The theory of operation and the working principles of induction watt-hour meters were points discussed by Mr. V. L. Hollister in a paper read at the recent A. I. E. E. convention. Attention was called to the fact that the operation of most domestic induction meters cannot be explained by the revolving-field theory, for if this applied meters with drum-shaped rotors would have much weaker unit torque than those with flat disks, a condition which is not borne out by the facts. It was shown that the accuracy of a meter will not be maintained with frequencies and ranges of temperature different from those for which it is designed unless a compensating winding and a shunt coil with a zero-temperature resistivity coefficient are provided. A mathematical explanation was given for the accuracy of induction meters with widely different wave-forms. The rotating-field principle on which some of the foreign instruments operate was treated mathematically, and the construction of shifting-field meters was described.

Electricity in a Massachusetts Shoe Factory

Motor-driven Equipment, Electrically Heated Devices and Connected Load of a Factory Entirely Operated by Electrical Energy

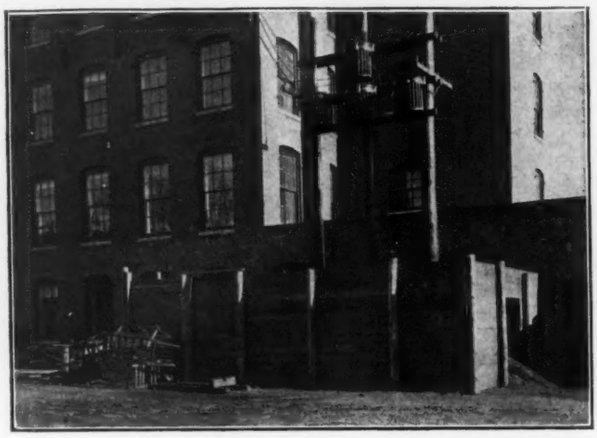
By Thomas D. Bond, Power Engineer*

THE extensive use to which electric motors can be put in the making of shoes is well illustrated in the case of a Haverhill (Mass.) shoe factory. From the time the hides are cut, on the top floor of the building, to the time when the Goodyear-welt shoe leaves the factory, about 150 operations have been performed.

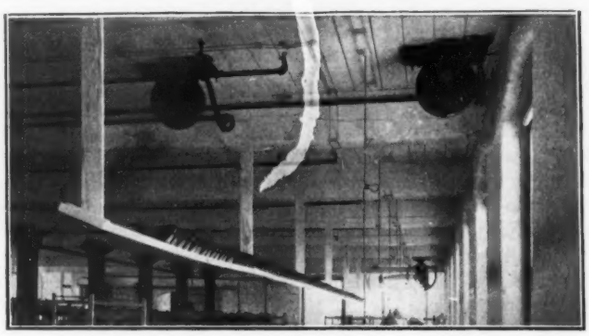
In the case mentioned motor-driven presses are used for cutting out the uppers and linings of shoes. Each press has two 25-watt tungsten-filament lamps equipped with holophane shades for illuminating the work. The sewing machines in the stitching room are so arranged that generally twenty-four machines are driven through a counter shaft under the bench by a 2-hp. or 3-hp. motor and Morse silent-chain drive. In addition to adequate general illumination, each machine is equipped with a 15-watt lamp and shade attached to a flexible arm capable of being adjusted to the lighting requirements of the operator. In this room are also installed an electrically heated crimping machine using 1100 watts, a backing press using 650 watts, a power press using 1000 watts, and an embossing machine using 170 watts.

TABLE I—MOTOR-DRIVEN MACHINES IN HAVERHILL SHOE FACTORY

Floor	Motor, Hp.	Motor, R.P.M.	Machine Driven
Basement	7.5	1200	Elevator
	5	1200	Pump
	7.5	1200	Channelling
	2	1800	Channelling
	10	1200	Elevator
	3	1800	Channeling
	20	1800	Dying out
	1	1800	Machine shop
First	3	1800	Stitching
	5	1800	Dinking
Second	2	1800	Buffing
	1.5	1800	Stamping
	5	1800	Buffing
Third	2	1800	Finishing brushes
	7.5	1200	Edge setting
	10	1200	Edge setting
	10	1200	Edge setting
	10	1200	Heel shaving
	7.5	1200	Scouring
	20	1200	Blower
	15	1200	Blower
	2	1800	Buffing
Fourth	5	1200	Trimming
	5	1800	Stitching
	3	1800	Beating out
	5	1800	Slugging
	7.5	1200	Stitching
	7.5	1200	Beating out
	3	1800	Pulling over and last.
	2	1800	Pulling over and last.
	15	1200	Stitching
Fifth	1	1800	Miscellaneous
	7.5	1200	Rotary pounders
	5	1800	Rotary pounders
	1	1800	Stitching
	2	1800	Stitching
	3	1800	Stitching
	0.75	1800	Crimping
	2	1800	Stitching
	2	1800	Stitching
	2	1800	Stitching
	2	1800	Stitching
	3	1800	Stitching
	1	1800	Stitching
	7.5	1800	Sole stitching
	7.5	1800	Sole stitching
Sixth	7.5	1200	Clicking machines
	3	1800	Crimping
	5	1200	Clicking machines



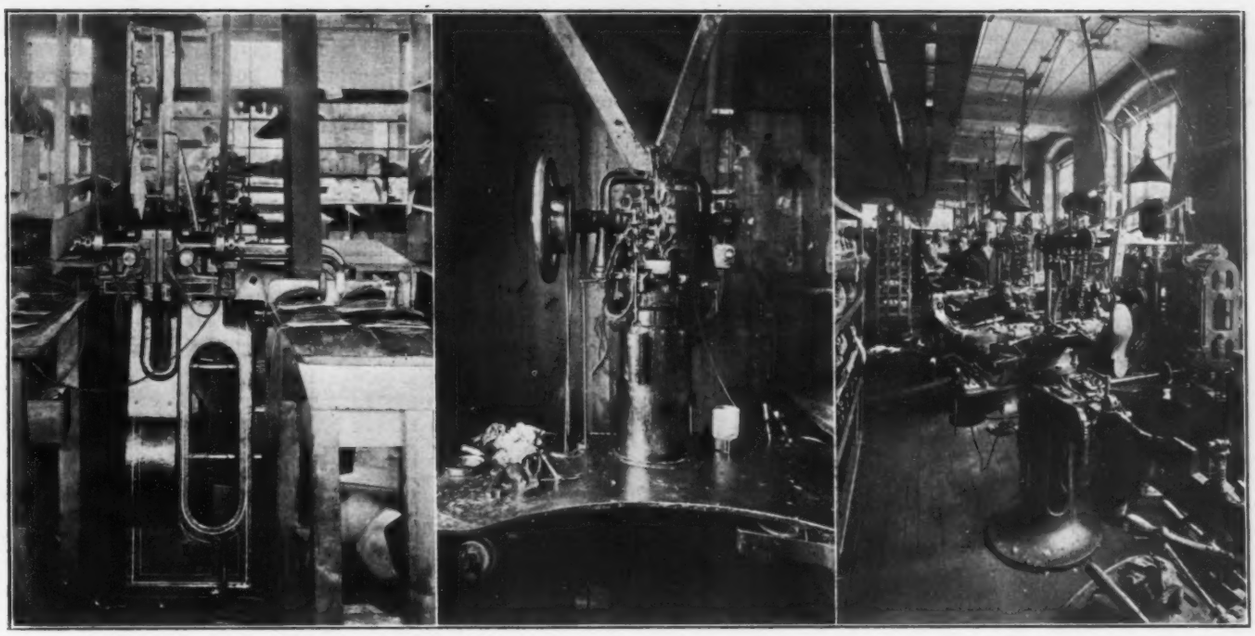
TRANSFORMER AND SERVICE LEADS INTO HAVERHILL SHOE FACTORY



MOTORS CONNECTED BY SILENT CHAINS TO STITCHING MACHINES ABOVE

TREEING MACHINES USING ELECTRIC IRONS TO REMOVE WRINKLES MADE BY LASTING MACHINE

*Haverhill Electric Company, Haverhill, Mass.



ELECTRICALLY HEATED CRIMPING MACHINE; ELECTRICALLY HEATED, MOTOR-DRIVEN STITCHER; ELECTRICALLY HEATED, MOTOR-DRIVEN TREEING MACHINES

In finishing insoles the first operation consists of applying a layer of duck or canvas to the insole. The duck comes prepared with a coating of compound which only requires heat to make it adhere to the insole. Here again electricity is used for heating purposes, the duck being passed over an electrically heated surface. The duck-coated insole is then tacked onto the last, and the combination passes along to the lasting room, where the uppers are attached.

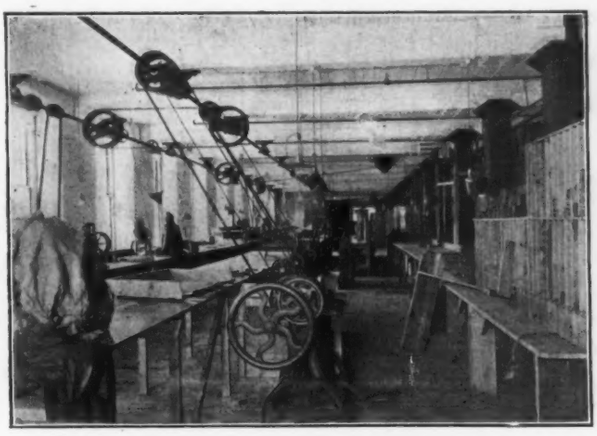
TABLE II—ELECTRICALLY HEATED APPARATUS USED IN HAVERHILL SHOE FACTORY

No.	Machine	Watt Consumption	Maker
3	Crimping machine	Two heats, 1100-550	Boston Last Co.
4	Flatiron	300	General Electric Co.
2	Backing press	650	Boston Last Co.
8	Bottoming iron	180	Boston Last Co.
3	Inseam and turn-sole machine	400	Haverhill Shoe Mach. Co.
2	Bottom drier	1200	Haverhill Shoe Mach. Co.
1	Atlas level machine	363	U. S. M. Co.
12	Tool heater	175	Boston Last Co.
8	Miller power treeing machine	2000	A. O. Miller Treeing Mach. Co.
2	Plate	150	Boston Last Co.
1	Savaday rack	2000	The Savaday Rack Co.
30	Treeing irons	180	Boston Last Co.
2	Vamp-creasing machine	120	A. O. Miller Treeing Mach. Co.
3	Embossing machine	170	Boston Last Co.

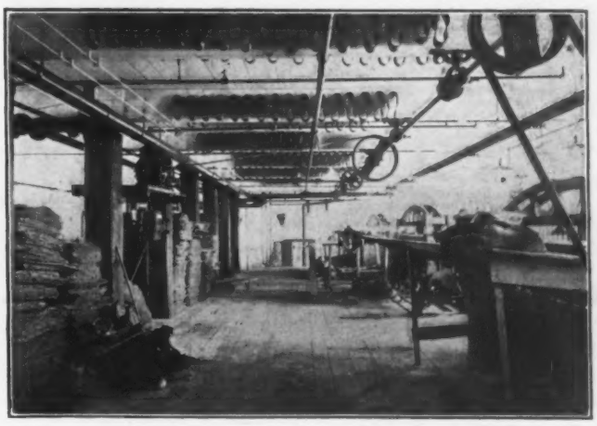
In the lasting room saturated steam is used to steam the tips of shoes, for the reason that no satisfactory electrical method for doing this work is yet in common use. Electricity, however, plays a part also in this department in that a modified form of a treeing machine, with electrically heated irons, is used to remove wrinkles that may have been caused by the lasting machine.

In the making room electricity is much in evidence. Here electrically heated welting machines are employed for stitching the insole, upper and welt in a single operation and with exceedingly great speed. This machine uses a wax pot which is electrically heated by two 100-watt heating units, the temperature being under the control of a rheostat. The head of every machine is heated by two 150-watt units, and each machine is driven by a 0.75-hp. motor.

The welted shoe is then treated with a bottom filling of cork and glue from an electrically heated glue kettle. An outer sole is sewed on by a machine similar to the welt-sewing machine. Edge setters, bottom driers, burnishers, etc., all electrically heated, are employed in the heeling and finishing rooms.



MOTOR DRIVE IN STOCK FITTING ROOM



MOTOR DRIVE IN SOLE-CUTTING ROOM

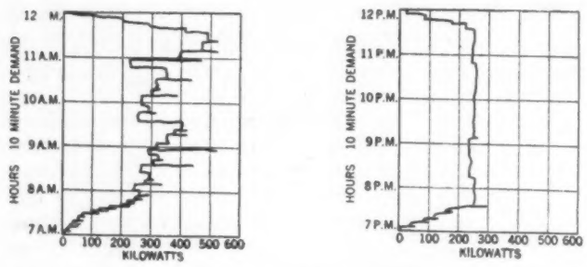
In the treeing room, where the final finishes are applied to the shoe, the electrically heated treeing iron is used. The even temperature at which these irons operate enable an operator to do fine work. An individual motor-driven automatic treeing machine is also employed. It does the work of two men. The manufacturer's trade-mark and other marks are impressed on the sole of the finished shoe by an electrically heated stamping machine. The creases across the vamp are also made by an electrically heated machine.

In all, about 275-hp. of electrical energy is used and forty-nine motors are installed. Approximately 1900 tungsten-filament lamps are also in use, most of which are of the 25-watt size.

OPERATING NEEDS OF GRAIN ELEVATORS

Electrical Equipment Rating, Load Conditions and Service Rates

The extent to which electricity is used by the grain elevators operated from the Port Arthur and Fort William substations of the Kaministiqua Power Company, Fort William, Ont., was shown by Mr. H. E. Stafford, in a paper read at the recent A. I. E. E. convention. A detailed account of equipment was given, and in some cases operating data and costs were included. The author briefly described the various steps through which the grain must go in its handling in the elevators. Owing to conditions peculiar to the industry, the day load is irregular while the night load is practically constant, as is shown by the accompanying load curves. The cost per kilovolt-ampere for the average 22,000-volt station, including building transformers, synchronous condensers, high-tension and low-tension apparatus, etc., ranges from $37.77 (the lowest) to $42.75 per kilovolt-ampere. The cost for a 2200-volt station is from $36.65 to $39.72 per kilovolt-ampere.



TYPICAL DAY LOAD AND TYPICAL NIGHT LOAD FIRST FIVE HOURS

TABLE II—POWER REQUIREMENTS OF ELEVATORS

	Total Hp.	Average Hp.
Electric (maximum demand)	14,412.5	8,680
Electric (flat rate)	495	475
Steam	4,710	3,105
Combined steam and electric	800	300
Total	20,417.5	12,560

The flat-rate charge is $25 per horsepower, while the maximum demand is figured on the following basis:

	Kw.
Maximum demand	280.0
Transformer losses on maximum demand	5.5
Total	285.5

285.5 kw. = 383 hp.

	Kw.-hr.
Kilowatt-hour consumption	28,140
First fifty hours, 285.5 × 50	14,275
Second fifty hours, 285.5 × 50	14,275
Total	28,550
Kilowatt-hour consumption	28,140
Excess	410

383 hp., at $1 per hp. per month	$383.00
First fifty hours, 14,275 kw.-hr., at 1.3 cents	189.85
Second fifty hours, 14,275 kw.-hr., at 1 cent	142.75
Excess, 410 kw.-hr., at 0.1 cent	0.41
Total	$716.01
Discount, 10 per cent.	71.60
Charges per month for 280 kw	$644.41

This gives a rate of $27.62 per kilowatt per annum, but for reasons quoted by the author it would be misleading, he declared, to quote any figure on the actual cost per kilowatt per annum.

TABLE I—ELECTRICAL EQUIPMENT OF GRAIN ELEVATORS

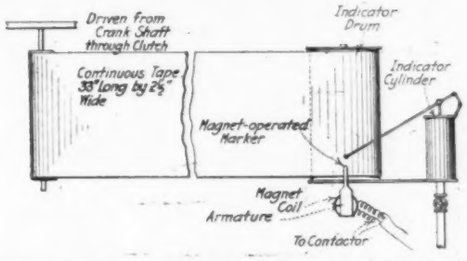
No.	Name	No. Plants	Grain Capacity, Bushels	Motor Rating, Hp.	Engine Rating, Hp.	Boiler Rating, Hp.	Average Hp.		Transformer Rating, Kva	Condenser Rating, Kva	Load-Factor[1]	Power-Factor
							Elec	Steam				
1	Western Terminal	1	2,000,000	1,140½			700		750	250	25%	90%
2	Fort William elevator	1	1,500,000	365	800	500	100	200				
3	Consolidated elevator	1	1,750,000	1,007			600		750	200		90
4	Canadian Pacific Railway[6]	1	8,000,000	2,000			1400		1,764	588		90
5	Canadian Northern Railway[3]	2	9,500,000	765	2000	2000	385	1700	450	200		92
6	Grand Trunk Pacific Railway	1	5,750,000	1,800			1500		2,025	750		90
7	Horn Elevator	1	800,000		600	1200		600				
8	Ogilvie Milling Company	1	1,250,000[2]	2,000			1300		1,800			90
9	Grain Growers Company	3	2,500,000	1,450			900		600	600	45%	90
10	Eastern Terminal	2	1,250,000	1,300			450		525	450	12.15%	90
11	Empire Elevator[5,7]	1	1,750,000		650	550		300				
12	Thunder Bay Elevator[5,8]	1	1,500,000		650	550		300				
13	Canadian Government elevator	1	3,125,000	2,150			1000		1,300	750		92
14	Smith-Davidson Company	1	750,000	500			125		450	150		92
15	N. M. Paterson Company[4]	2	175,000	250			250		270			90
16	Parrish & Heimbecker[4]	1	100,000	145			125		150		45%	90
17	Bole Grain Company[4]	1	20,000	20			20		20			90
18	Muirhead & Company[4]	1	30,000	30			30		30			90
19	Guy Elevator Company[4]	1	35,000	50	10	15	50	5	45			90
20	Dwyer Elevator Company	1	100,000	110			90		120			90
21	Muirhead & Black	1	165,000	100			130		120			90
22	National Elevator Company	1	40,000	90			100		90			92
	Total	27	42,090,000	15,272½	4710	4815	9255	3105	11,259	3038		

[1]Load-factor not available in most cases as no accurate records are kept. [2]Capacity 3000 bbl. per day. [3]Maximum demand charge, $27.618. [4]Flat-rate charge, $27 per hp. [5]Cost per bus, 0.057 cent. [6]Cost per ton of coal, $4.

Operating Kinks

Endless-Tape Indicator Cards

Whenever the curves obtained with an ordinary indicator are too small for minute study, an endless tape arranged for operation as shown in the accompanying illustration may be used to good advantage. In order that such a tape may be used with a standard indicator the spring and stop should be removed from the barrel. Then a wooden drum may be supported on a spindle parallel to the indicator drum and far enough from it



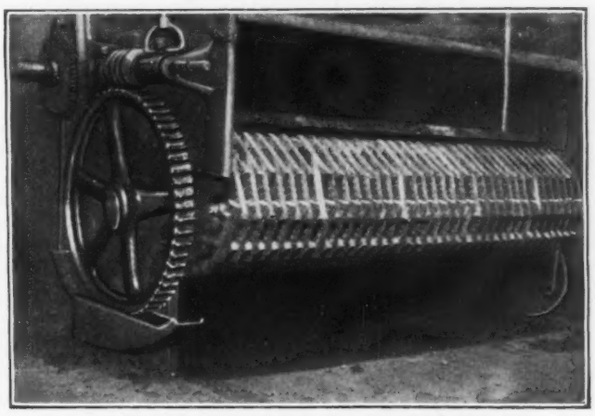
INDICATOR ADAPTED TO USE ENDLESS-TAPE CARD

to allow the desired length of tape to connect the two. The spindle of the wooden drum should be driven through a belt and clutch from the engine shaft. To indicate when the piston of the engine being tested reaches the end of its travel a magnet-operated device such as shown may be employed to make a mark beneath the main marker. Apparatus similar to this has been used at the Royal Technical College, Glasgow, Scotland, for investigating the changes in pressure during the combustion stroke of Diesel oil engines.

Arrangement to Make a Stoker Self-Oiling

One of the causes of serious wear and tear on stoker-driving mechanisms is lack of proper attention by operators to lubrication. In the more recent designs of stoker equipment steps have been taken by the makers to provide oil to the moving parts continuously. However, many of the older types in use are still at the mercies of the firemen.

The accompanying halftone illustration from a photograph taken in the power house of the Union Electric Company at Dubuque, Iowa, shows how this trouble was handled at small expense. An oil container or pan was placed beneath the large gear wheel shown so that the revolving teeth dip into the lubricant at each turn. These teeth carry the oil to the worm wheel and keep the contact points well lubricated.



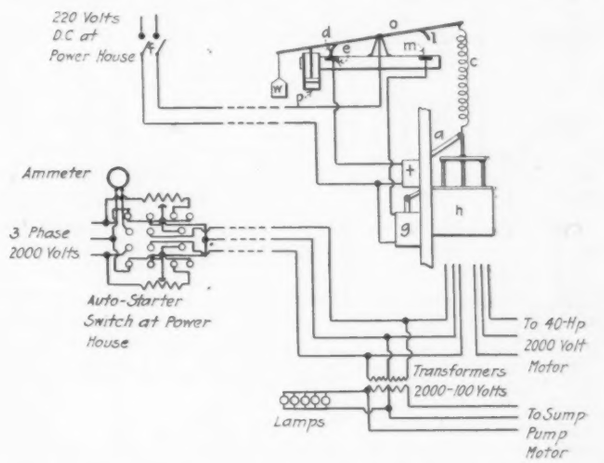
A SIMPLE AND EFFECTIVE STOKER OILER

In this instance the oil pans were purchased from the stoker manufacturers and installed after the stokers had been working for some time. The oil used for this purpose is not new oil, but is that which is collected after being used in other station machines and practically unfit for use in any other way.

Method for Controlling 2000-Volt Induction Motor One Mile from Power House

BY A. C. LASHER*

The accompanying illustration shows a method of operating the closing and tripping coils of a standard make of remote-control electrically operated oil switch from a single two-wire control circuit. The installation which led to the development of the device consists of a 40-hp, 2000-volt, three-phase motor driving a turbine pump installed nearly a mile from the power house. A small 2-hp, 100-volt motor, also three-phase, is connected to a sump pump for removing leakage from the pump well, which is situated at the river's edge, with the floor and machinery normally below water level. The small step-down transformers for operating the sump pump furnish current for lighting the pump house and for a telegraph office and block signal near by. The service required of the large pump is intermittent, but the telegraph office must have all-night service and



CIRCUITS FOR CONTROLLING OIL SWITCH FROM TWO-WIRE CIRCUIT

power must be available at all times for operating the sump pump when necessary.

The inexpensive device shown permits the electrically operated switch to be either opened or closed from the power house by one pair of wires, at a considerable saving in the initial investment and convenience in operation. By referring to the diagram it will be observed that, in addition to being provided with the electrically operated oil switch at the pump house, the 40-hp motor is controlled from an auto-starter at the power plant. With the 2000-volt circuit closed through the oil switch *h* at the pump house, the oil-switch lever *a* is up, with the coil spring *c* relaxed and the counterweight *w* down so that point *d* makes contact in the mercury cup *e*. If the pilot switch *f* is now closed, a circuit is formed through the tripping coil *t*, and the switch opens. Conversely, with the oil switch *h* open, the lever *a* is down, and spring *c* is in tension, causing *d* to rise from the mercury cup *e* and the point *l* to fall and make

*Electrical engineer Central of Georgia Railroad shops, Macon, Ga.

contact with the mercury cup *m*. In this condition the closing of the pilot switch *f* establishes a circuit through the closing coil *g*, and the switch is closed.

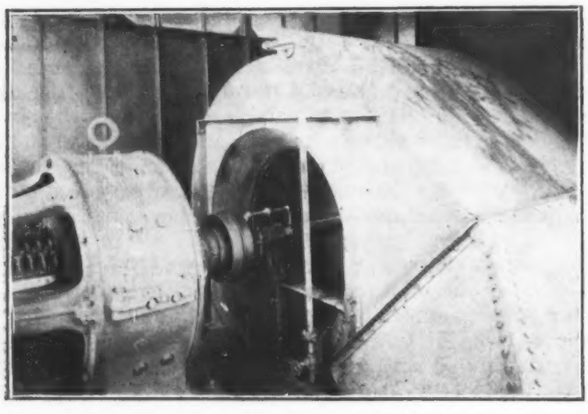
The dash pot *p* is adjusted so that the beam *o* moves from one extreme to the other in about ten seconds. As it requires only a moment for either the closing or the tripping coils to act, it is only necessary to close the pilot switch for a very short interval of time. However, if the switch has been thrown to one position and it is desired for some reason to change immediately back to the first position, the operator must allow a sufficient interval of time to elapse for the device to come to rest, since if the pilot switch is closed while the points *d* and *l* are in their mid-position, neither coil will be energized.

The auto-starting switch at the power house is provided with an ammeter, which enables the operator to observe whether or not the large pump is running. If the auto-starter switch is open and the operator is in doubt as to the position of the electrically operated switch, he has only to manipulate the auto-starter switch as though starting the pump in the usual manner. The ammeter will indicate whether or not the pump is on the line. While no harm can result from opening the switch *h* at any time, whether or not the pump is running, it will be readily understood that this switch should not be closed when the auto-starter switch is open.

Supplying Air to Generators at Constant Temperature and Humidity

An interesting arrangement to remove dust and grit from the ventilating air passing through the windings of a large generating unit is being successfully used at the Gold Street station of the Edison Electric Illuminating Company of Brooklyn, N. Y. The scheme used thoroughly washes the air and delivers it to the generator at a fairly constant temperature and humidity. Danger of excess dust and moisture being forced into the windings is prevented by a simple separator arrangement which takes advantage of the tendency of bodies to resist change of direction when in motion.

The operation of this air-washing arrangement is shown in the accompanying diagram. Air enters a motor-driven blower at *A* and is forced by the fan blades at high velocity past a supply of water maintained in reservoir *E*. The air picks up particles of water and produces a water film around the fan casing as shown by the arrows. The centrifugal effect created by the fan blades and the inertia of the dust particles causes these particles to pass through the air to the fan casing and be washed away by the water film lining this casing.



AIR WASHER AT THE GOLD STREET STATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN

The air is further washed by coming into contact with a divided stream of water furnished by pipe *O*, near the top of the casing, and so placed as to increase the water film and produce a spray at the entrance of duct *B*. The moist air from duct *B* passes through a set of ventilating baffle plates in a zig-zag path to remove the excess

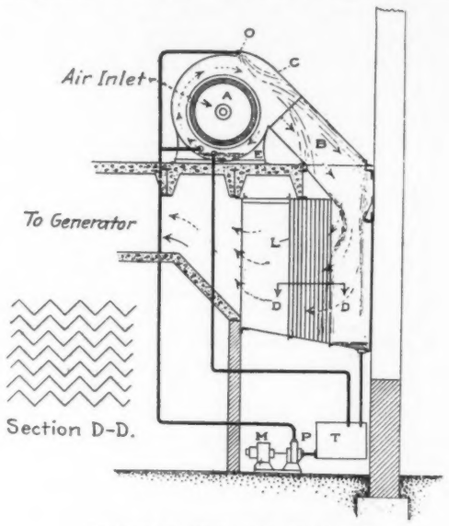


DIAGRAM FOR AIR WASHER

moisture before reaching the generator windings. The specifications for this air washer call for a temperature of delivered air within 5 deg. of the wet-bulb temperature when the blower is delivering 70,000 cu. ft. of air per minute with a 4.5-in. pressure at its discharge.

A motor-operated pump of 50 gal. per minute capacity supplies water to tank *E* and pipe *O* from the return tank *T*. This arrangement was devised by the Metropolitan Engineering Company of Brooklyn, N. Y.

Hot and Cold Water Test for Insulators

A hot and cold water test for insulators has been employed by the Pennsylvania Water & Power Company to determine what types of insulators are most liable to be damaged by high internal stresses. In this test the heads of the insulators were dipped in cold water (7 deg. to 8.5 deg. C.) for five minutes, then immersed in boiling water for an equal period, and finally tested for resistance with a megger. Those which stood the treatment without any change in resistance were subjected to ten temperature changes and finally to a high-voltage test. By heating insulators which had been in service on the line for some time in a vacuum to a temperature of 50 deg. to 90 deg. C., it was found that the resistance gradually decreased and after several days rose again to infinity. When insulators which had been subjected to this treatment were subjected to high-voltage tests, it was found that they would break down at a much higher voltage than before being treated. The insulators which dried out the quickest punctured at the lowest voltages while those that dried out more slowly had considerably higher break-down values. From these observations it is concluded that insulators which have become unsuitable for service owing to absorption of moisture can be made safe for service by heating them in a vacuum and treating them so they will not absorb moisture again. Switching, surges, arcing grounds, high-frequency discharges, etc., it is claimed, can hardly be assumed to be the cause of insulator depreciation, since insulators have been damaged on lines continuously energized but not used to transmit energy.

Extracts and Abstracts

N. E. L. A. Rules to Harmonize Service Requirements for Motors

Rules to govern the installation and use of motors on central-station distributing systems were proposed by the National Electric Light Association committee on new apparatus at the convention held recently at San Francisco. These rules aim to harmonize the service requirements for motors in different cities. They also furnish a more definite basis for figuring current values by giving the limits for the starting current in amperes per horsepower of rating instead of a multiple of the rated full-load current. The rules as they are to be tried out during the present year by central-station companies are as follows:

As voltage regulation is affected by the amount of current taken from the line, a motor exceeding the maximum allowed starting current will not be connected to the lines, as its operation would prevent successful service. To avoid misunderstandings, the exact characteristics of the service which will be furnished—that is, direct current or alternating current, voltage, and with alternating current also frequency and phase—

TABLE I—PERMISSIBLE STARTING CURRENT FOR SINGLE-PHASE SIXTY-CYCLE MOTORS

Rating		Maximum Permissible Amperage
Horsepower	Volts	
0.5 and below	220	15
Above 0.5 to 1 inclusive	220	20
Above 1 to 5	220	Amp. per Hp. 15
Above 5	220	11

must be ascertained from the central-station company by the prospective user of power.

The instantaneous current (determined by test or based on value guaranteed by manufacturer) drawn from the line by any motor (with the starting device, if any required, in the starting position) must not exceed the value for the rated horsepower of such motor as

TABLE II—PERMISSIBLE STARTING CURRENT FOR POLYPHASE SIXTY-CYCLE MOTORS

Rating		Maximum Permissible Amperage per Phase per Hp.	
Horsepower	Volts	Two-Phase	Three-Phase
1 and below	220	17.3	20
Above 1 to 2 inclusive	220	15.2	17.5
Above 2 to 5 inclusive	220	11.2	13
	440	5.6	6.5
	550	4.5	5.2
Above 5 to 30 inclusive	220	8.	9.
	440	4.	4.5
	550	3.2	3.6
	2200	1.	1.
Above 30	220	5.2	6.
	440	2.6	3.
	550	2.1	2.4
	2200	0.5	0.6

obtained from the accompanying tables. In a group installation the largest amount of starting current permitted for any motor of the installation shall be the limit of starting current for any other motor of the group.

The limits of starting current in Table II are intended to be such that starting devices for polyphase motors will be required for motors above 5 hp. where the installation consists of a single motor of such size. Instances may occur wherein it may be necessary to use a starting device on 5-hp. motors. In any installation where starting devices are normally required it shall be optional with the operating companies to approve

TABLE III—PERMISSIBLE STARTING CURRENT FOR SHUNT-WOUND AND COMPOUND-WOUND DIRECT-CURRENT MOTORS

Rating		Maximum Permissible Amperage per Hp.
Horsepower	Volts	
3 and below	230	12
	550	5
Above 3	230	9
	550	4

the omission of the starting devices on motors of certain capacities.

Motors that cannot be safely subjected to full voltage at starting must be provided with a device to insure that on failure of voltage either the motor will be disconnected from the line or the starting device will be returned to the starting position.

Reverse phase relays and circuit-breakers or equivalent devices are recommended on all polyphase elevator installations, cranes and similar service to protect the installation in case of phase reversal. Should special conditions seem to warrant an exception to the above rules, the case must be referred to the company for consideration and decision.

Motors requiring not more than 30 amp. starting current may be connected for 110-volt service. The maximum size of a single-phase motor to be permitted on one phase of polyphase systems should be 5-hp., larger sizes to be installed only after securing special permission.

No direct-current motor larger than 0.75 hp. may be connected to a 115-volt circuit. Direct-current, 115-volt motors up to 0.5 hp. shunt-wound and 0.75 hp. compound-wound, but in no case exceeding 30 amp. starting current, may be installed without starting resistance.

The current values of the tables are those indicated by a suitable well-damped ammeter in the motor circuit on the line side of the starting device, and are 75 per cent of the permissible locked rotor values.

Discussions of Motor Applications at A. I. E. E. Meetings

Mr. D. B. Rushmore's paper at the Deer Park, Md., convention of the A. I. E. E. gave a brief outline of the points of interest in the industry and pointed out the factors involved in the application of electric motors to manufacturing processes. It was intended to serve as an introduction to a discussion which would bring out the points of interest in the various industries in which the electric motor has been applied. The author furnished a tentative list of points of interest involved in investigating the application of electricity to various industries. A diagram of costs representing the practice of no one particular company was presented, showing a method of estimating costs. This paper represented the fourth and last part of a treatment of industrial motor applications, the other parts of which have related to electric motors, electric controllers, and the factors involved in motor applications, and were presented respectively at the New York, Pittsburgh and Cleveland meetings.

Questions and Answers

Effect of Heat on Watt-Hour Meter

What effect, if any, would the heat of the sun have on the operation of a watt-hour meter? A. D. W.

In those types of meters where oil is used for lubrication, the heat from the sun would probably cause the oil to gum, thereby causing friction enough to make the meter run slow. Meters should not be installed in exposed places.

Double Tubes in Steam Injector

Why are some forms of injectors made with two tubes instead of one? E. A. S.

In a double-tube injector, one of the tubes acts to lift the water and deliver it to the second tube, and the second tube forces it on into the boiler. In a single-tube injector the lifting and forcing are done by the same tube.

Nature of Volatile Matter in Coal

What is the volatile matter in coal? Is it a solid, a liquid or a gas? L. G. Van B.

The volatile matter is the part of the dry coal that is driven off as vapors and gases by heating the coal in a crucible with the flame of a blast lamp. It consists of combined water, nitrogen, sulphur and hydrocarbons. The water is in the liquid state, the nitrogen is a gas, the sulphur is a solid, and the various hydrocarbons probably exist in all three states.

Test for Moisture in Oil

Describe some simple method of determining when moisture is present in transformer oil. L. C. N.

A very simple test for determining the presence of considerable water in oil is to dip a hot wire nail in it. This will cause good oil to smoke slightly with very little noise. If water is present, however, a peculiar hissing sound will be heard. To obtain satisfactory operation from transformers all trace of moisture in the oil should be removed and a standard oil-testing equipment should be used to test for this condition.

Insulation for Cold-Storage Room

We are planning to add an ice machine to our central-station plant, and would like to get some advice on the best means of insulating the cold-storage room. K. N. L.

The standard insulation used for cold-storage rooms is pure cork sheeting of a thickness of 4 in. The following table, however, shows the heat transmitted per twenty-four hours through 1 in. of each of the following substances per square foot of exposed surface per degree difference in temperature:

	Lb.-Fahr. Heat Units
Pure cork sheets	6.4
Hair felt	7.3
Impregnated cork boards	8.5
Rock wool blocks	8.0
Spruce	16.0
Oak	26.0

Laying Up an Idle Return-Tubular Boiler

If a return-tubular boiler is to be idle for some time, what is the method to be followed in laying it up empty? D. G. A.

If a shell boiler is to be laid up empty for a time, it must be thoroughly cleaned and dried. The blow-off cock is opened and the boiler is drained, and then the manhole covers are removed so that the inside of the boiler can be reached. The shell and the tubes are scraped and washed clean. The outside is then swept so as to remove all deposits of soot and cinders, and the fire tubes are blown out for the same reason. When the boiler is thoroughly clean inside and outside, unslaked lime should be placed at those points where moisture is likely to collect, as, for example, inside the boiler shell, in the combustion chamber and the furnace, and in the uptake at the front. The lime can be put in trays, and it will absorb the moisture and prevent the latter from rusting the shell or causing corrosion. If the lime becomes slaked before the boiler is to be put into service, it should be replaced by a fresh supply.

Trouble on Commercial Telephone Lines Paralleling High-Tension Transmission Lines

In the case of a star-connected system with transformer and generator neutrals grounded, why is it that trouble is sometimes experienced on parallel telephone circuits? B. T.

In the case of trouble on such a system current may flow through the ground to the neutral, and in such a case will follow the path of least resistance. If the telephone line has a low resistance to ground, as in the case of commercial circuits, current may flow along these lines with disastrous results. When grounds are made on the low-tension side of the system so as to give the best protection and cause the least trouble the disturbance to telephone lines should be small. Trouble of the kind mentioned is liable to take place when the neutrals of high-tension windings of transformers are grounded and the opening of one or two of the transmission wires causes current to flow through the ground. Also trouble may arise in case of a high-resistance ground on a transmission-line wire which partially short-circuits a transformer and causes current to flow through the ground to the neutral.

Preventing Flashovers on Rotary Converters

What causes flashovers on synchronous converter commutators, and how may they be prevented? C. N. A.

Flashovers are usually caused by potential surges, sudden changes in load and severe short-circuits. The effect of potential surges may be minimized or entirely prevented by connecting electrolytic lightning arresters directly across the positive and negative leads, and preferably inside the series field connections, to reduce the impedance of the discharge path. Experience on one large system, according to the recent report of the National Electric Light Association committee on electrical apparatus, indicates that not less than one set of arresters should be installed for each 500 kw. of converter equipment. It was recommended that no spark-gap be used in the lightning-arrester circuit, as it would decrease the value of the protection. Even with this protective installation, flashovers have occurred on the alternating-current rings, so that it may be advisable to provide spark-gaps between the secondary terminals of the step-down transformer and ground as an additional precaution, although the cause of such alternating-current flashovers and the efficacy of spark-gaps as a cure have not as yet been proved. Spark-gaps, if installed, should have a limiting resistance in series with them of about 1700 ohms in each phase. As a further precaution and to minimize the extent of trouble which may follow a flashover, it is desirable to insulate the frames of the converters from ground and provide grounding connections. Frames may be grounded either through a resistance or through a relay which will disconnect the unit from both the supply and delivery circuits when any appreciable amount of current passes from the frame to ground.

COMMERCIAL SECTION

The Public-School Boy as a Pathfinder

How the Louisville Gas & Electric Company Uses Youngsters from the Local Schools to Hunt for Appliance "Prospects"

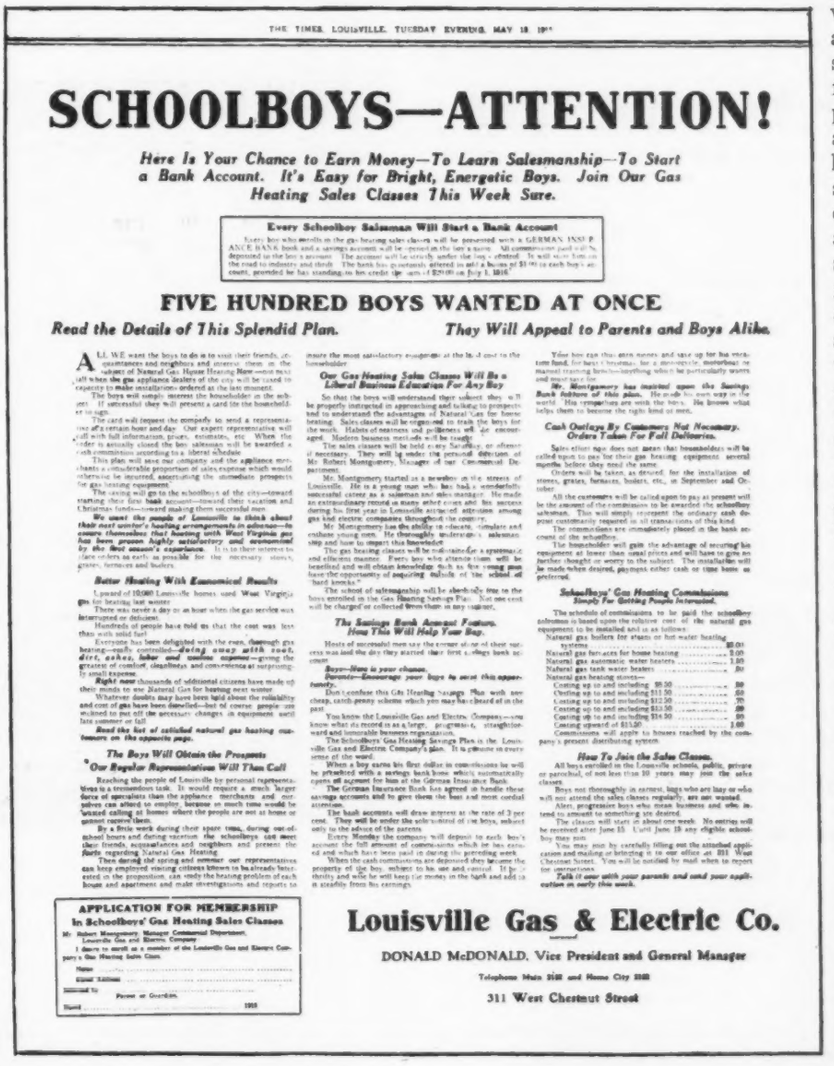
AN interesting experiment is being made in Louisville, Ky., in the utilization of the schoolboy as a pathfinder to go before the salesman in search of appliance business. The idea is original with Mr. W. H. Hodge, publicity manager for H. M. Byllesby & Company, who operate the Louisville property, but the campaign has been organized and is being operated by Mr. Robert Montgomery, manager of the local commercial department. The primary object was to introduce a bit of novelty and human interest into an appliance campaign, but the scheme is succeeding so well that it is far surpassing expectation.

The plan was simple and appealing. The company advertised that 500 boys were wanted at once to canvass the city in the interest of natural-gas heating, this being selected as the first issue of the company. The boys visit their friends and neighbors and call from house to house, telling the people of the advantages of the service in accordance with a carefully prescribed selling talk taught them in advance. In each case the boy endeavors to secure the signature of the prospective customer on a stamped post card which is addressed to the company and requests a salesman to call regarding some appliance listed on the card and checked by the customer. This card the boy immediately deposits in the nearest mail box as he goes on his way. On the card it is stated that if any sale results from the salesman's call a commission will be deposited in a savings-bank account for the boy who made the first solicitation, to be drawn out by him at pleasure.

From the point of view of the public, the situation is interesting. It offers the schoolboys three definite objectives with which every man and woman is in sympathy. It affords him an opportunity to save a bit of money for himself, it opens a savings-bank account for him, and it starts the saving habit. It gives him lessons and experience in salesmanship that will benefit him all his life. Naturally, the parents and the friends of every boy respond heartily and speed the campaign on its way. In fact, the small boy has a peculiar advantage in the work, for his enthusiasm is keen and persuasive, and the average man or woman finds it hard to refuse attention to his plea.

In the original purpose of the campaign the actual inquiries that the company expected to secure through the work of the boys were the secondary consideration. The main objective was the advertising benefit that must naturally follow the activities of so many eager agents, spreading the message throughout so many homes.

The campaign was announced in double-page "spreads" in the local newspapers, which heralded the



THE TIMES, LOUISVILLE, TUESDAY EVENING, MAY 18 19[illegible]

SCHOOLBOYS—ATTENTION!

Here Is Your Chance to Earn Money—To Learn Salesmanship—To Start a Bank Account. It's Easy for Bright, Energetic Boys. Join Our Gas Heating Sales Classes This Week Sure.

Every Schoolboy Salesman Will Start a Bank Account

Every boy who enrolls in the gas-heating sales classes will be presented with a GERMAN INSURANCE BANK book and a savings account will be opened in the boy's name. All commissions paid will be deposited to the boy's account. The account will be strictly under the boy's control. It will serve him as a ready reference to industry and thrift. The bank has graciously offered to add a bonus of $1.00 to each boy's account, provided he has standing to his credit the sum of $25.00 on July 1, 1915.

FIVE HUNDRED BOYS WANTED AT ONCE

Read the Details of This Splendid Plan. They Will Appeal to Parents and Boys Alike.

ALL WE want the boys to do is to visit their friends, acquaintances and neighbors and interest them in the subject of Natural Gas House Heating *Now*—soon next fall when the gas appliance dealers of the city will be taxed to capacity to make installations ordered at the last moment.

The boys will simply interest the householder in the subject. If interested they will present a card (to the householder to sign.

The card will request the company to send a representative at a certain hour and day. Our expert representative will call with full information, prices, estimates, etc. When the order is actually closed the boy salesman will be awarded a cash commission according to a liberal schedule.

This plan will save our company and the appliance merchants a considerable proportion of sales expense which would otherwise be incurred, ascertaining the immediate prospects for gas heating equipment.

The saving will go to the schoolboys of the city—toward starting their first bank account—toward their vacation and Christmas funds—toward making them successful men.

We want the people of Louisville to think about their next winter's heating arrangements in advance—to assure themselves that heating with West Virginia gas has been proven highly satisfactory and economical by the first season's experience. It is to their interest to place orders as early as possible for the necessary stoves, grates, furnaces and boilers.

Better Heating With Economical Results

Upward of 10,000 Louisville homes used West Virginia gas for heating last winter.

There was never a day or an hour when the gas service was interrupted or deficient.

Hundreds of people have told us that the cost was less than with solid fuel.

Everyone has been delighted with the even, thorough gas heating—easily controlled—*doing away with coal, dirt, ashes, labor and smoke nuisance*—giving the greatest of comfort, cleanliness and convenience at surprisingly small expense.

Right now thousands of additional citizens have made up their minds to use Natural Gas for heating next winter.

Whatever doubts may have been held about the reliability and cost of gas have been dispelled—but of course people are inclined to put off the necessary changes in equipment until late summer or fall.

Read the list of satisfied natural gas heating customers on the opposite page.

The Boys Will Obtain the Prospects *Our Regular Representatives Will Then Call*

Reaching the people of Louisville by personal representatives is a tremendous task. It would require a much larger force of specialists than the appliance merchants and ourselves can afford to employ, because so much time would be wasted calling at homes where the people are not at home or cannot receive them.

By a little work during their spare time, during out-of-school hours and during vacation the schoolboys can meet their friends, acquaintances and neighbors and present the facts regarding Natural Gas Heating.

Then during the spring and summer our representatives can keep employed seeing citizens known to be already interested in the proposition, can study the heating problem of each house and apartment and make investigations and reports to insure the most satisfactory equipment at the least cost to the householder.

Our Gas Heating Sales Classes Will Be a Liberal Business Education For Any Boy

So that the boys will understand their subject they will be properly instructed in approaching and talking to prospects and to understand the advantages of Natural Gas for home heating. Sales classes will be organized to train the boys for the work. Habits of neatness and politeness will be encouraged. Modern business methods will be taught.

The sales classes will be held every Saturday, or oftener if necessary. They will be under the personal direction of Mr. Robert Montgomery, Manager of our Commercial Department.

Mr. Montgomery started as a newsboy on the streets of Louisville. He is a young man who has had a wonderfully successful career as a salesman and sales manager. He made an extraordinary record as many school boys and his success during his first year in Louisville attracted attention among gas kind electric companies throughout the country.

Mr. Montgomery has the ability to educate, stimulate and enthuse young men. He thoroughly understands salesmanship and how to impart this knowledge.

The gas heating classes will be made equivalent to a systematic and effective manner. Every boy who attends them will be benefited and will obtain knowledge such as few young men have the opportunity of acquiring outside of the school of hard knocks."

The school of salesmanship will be absolutely free to the boys enrolled in the Gas Heating Savings Plan. Not one cent will be charged or collected from them in any manner.

The Savings Bank Account Feature. How This Will Help Your Boy.

Hosts of successful men say the corner stone of their success was laid the day they started their first savings bank account.

Boys—Here is your chance.

Parents—Encourage your boys to avail this opportunity.

Don't confuse this Gas Heating Savings Plan with any cheap, catch-penny scheme which you may have heard of in the past.

You know the Louisville Gas and Electric Company—you know what its record is as a large, progressive, straightforward and honorable business organization.

The Schoolboys' Gas Heating Savings Plan is the Louisville Gas and Electric Company's plan. It is genuine in every sense of the word.

When a boy earns his first dollar in commissions he will be presented with a savings bank book which automatically opens an account for him at the German Insurance Bank.

The German Insurance Bank has agreed to handle these savings accounts and to give them the best and most cordial attention.

The bank accounts will draw interest at the rate of 3 per cent. They will be under the sole control of the boys, subject only to the advice of the parents.

Every Monday the company will deposit to each boy's account the full amount of commissions which he has earned and which have been paid in during the preceding week.

When the cash commissions are deposited they become the property of the boy, subject to his use and control. It is his thrift and wise he will keep the money in the bank and add to it steadily from his earnings.

Your boy can thus earn money and save up for his vacation fund, for next Christmas, for a motorcycle, motorboat or manual training bench—anything which he particularly wants and must save for.

Mr. Montgomery has insisted upon the Savings Bank features of this plan. He made his own way in the world. His sympathies are with the boys. He knows what helps them to become the right kind of men.

Cash Outlays By Customers Not Necessary. Orders Taken For Fall Deliveries.

Sales effort now does not mean that householders will be called upon to pay for their gas heating equipment several months before they need the same.

Orders will be taken, as desired, for the installation of stoves, grates, furnaces, boilers, etc., in September and October.

All the customers will be called upon to pay at present will be the amount of the commissions to be awarded the schoolboy salesman. This will simply represent the ordinary cash deposit customarily requested in all transactions of this kind.

The commissions are immediately placed in the bank account of the schoolboy.

The householder will gain the advantage of securing his equipment at lower than usual prices and will have to give no further thought or worry to the subject. The installation will be made when desired, payments either cash or time basis as preferred.

Schoolboys' Gas Heating Commissions Simply For Getting People Interested.

The schedule of commissions to be paid the schoolboy salesmen is based upon the relative cost of the natural gas equipment to be installed and is as follows:

Natural gas boilers for steam or hot-water heating systems	$5.00
Natural gas furnaces for home heating	3.00
Natural gas automatic water heaters	1.00
Natural gas tank water heaters	.50
Natural gas heating stoves—	
Costing up to and including $9.50	.50
Costing up to and including $11.50	.50
Costing up to and including $13.50	.75
Costing up to and including $15.50	.00
Costing up to and including $14.50	.00
Costing upward of $15.50	1.00

Commissions will apply to houses reached by the company's present distributing system.

How To Join the Sales Classes.

All boys enrolled in the Louisville schools, public, private or parochial, of not less than 10 years may join the sales classes.

Boys not thoroughly in earnest, boys who are lazy or who will not attend the sales classes regularly, are not wanted.

Alert, progressive boys who mean business and who intend to amount to something are desired.

The classes will start in about one week. No entries will be received after June 15. Until June 10 any eligible schoolboy may join.

You may join by carefully filling out the attached application and mailing or bringing it to our office at 311 West Chestnut Street. You will be notified by mail when to report for instructions.

Talk it over with your parents and send your application in early this week.

APPLICATION FOR MEMBERSHIP
In Schoolboys' Gas Heating Sales Classes

Mr. Robert Montgomery, Manager Commercial Department,
Louisville Gas and Electric Company.

I desire to enroll as a member of the Louisville Gas and Electric Company's Gas Heating Sales Class.

Name .....
Street Address .....
Recommended by .....
Parent or Guardian.
Dated 1915

Louisville Gas & Electric Co.

DONALD McDONALD, Vice President and General Manager

Telephone Main 2122 and Home City 2122

311 West Chestnut Street

schoolboy offer conspicuously. Then quarter-page advertisements followed almost daily, and by the time school closed more than sixty boys were enrolled in the work.

Weekly Lectures by the Sales Manager

During the summer vacation days it is expected that several hundred youngsters will be canvassing, every one of them meanwhile attending weekly lectures in

LOUISVILLE GAS AND ELECTRIC COMPANY

GENTLEMEN:—Please send a representative to see me at_____ o'clock_____ Date_____ regarding

Gas Heating Stove - ☐ Gas Water Heater ☐
Gas Hot Air Furnace - ☐ Gas Hot Water Furnace ☐

It is understood that the school boys gas heating savings plan commission will be deposited to the bank account of the boy presenting this card providing an order is taken by your representative under the terms of the plan.

Yours truly,

No._____
Name of School Boy Salesman

Name_____

Address_____
(USE OTHER SIDE)

POST-CARD APPLICATION FORM SIGNED BY CUSTOMER

salesmanship. This course of instruction is being conducted by Mr. Montgomery personally, and consists of a lecture every Monday afternoon and a demonstration of some appliance, the lectures embracing definite lessons in salesmanship which the boys apply in their daily canvassing for the company.

Mr. Montgomery reports that the idea is proving a success. The number of boys engaged is steadily increasing, the public is both interested and amused at the youngsters' industrious activity, and a large number of new "leads" are being unearthed each week that are producing profitable business. So well is it working, in fact, that the company is planning to use the boys this fall in a house-wiring campaign, and the local manager of one of the lamp manufacturers has already applied to take over the entire youthful force for a tungsten-lamp campaign as soon as the Louisville Gas & Electric Company is willing to relinquish them.

Experience with Controlled Flat Rate at Dubuque

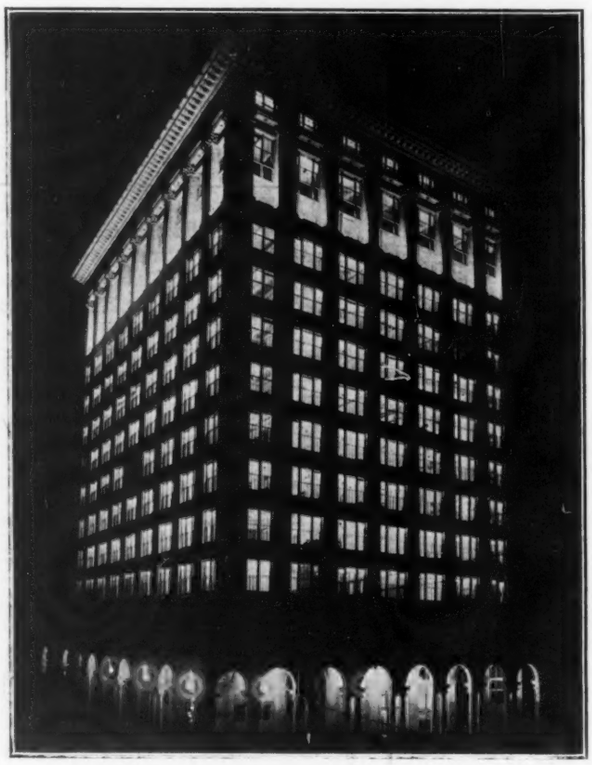
Because of the average central-station manager's dread of flat rates there is sometimes one class of desirable business which the central station does not get. This class is made up of small-residence lighting customers, usually workingmen, who live in small houses and have very limited incomes. In the experience of the Union Electric Company of Dubuque, Ia., however, the controlled flat-rate plan of service made possible through the use of current-limiting devices, affords a means of handling this class of business in a very satisfactory manner.

According to Mr. E. T. Hughes, general contract agent for the Union Electric Company of Dubuque, the company's records show that during 1914 about 1100 new names were added to the consumers' ledgers. Of this number, 390 were originally controlled flat-rate customers. Sixty of these 390 bought flatirons or other appliances before the year was out and had meters installed. The sales campaign on controlled flat-rate business was elaborate, and considerable money was spent in advertising and in salesmen's salaries, yet at the end of the year the sales cost per customer obtained was low.

From results obtained by placing meters on the lines of customers served through controllers it was found that in a number of cases the company was selling energy at the rate of 20 cents per kw-hr. The lowest rate discovered showed an equivalent of 9 cents per kw-hr. What is of chief importance, the company has found that in all cases its customers are satisfied. The monthly bill is always the same, without fluctuation to disturb the customer's financial arrangements. The consumer arranges his finances to care for his lighting as he does to care for his grocery bill. As the lighting bills are payable in advance, there are practically no unpaid or delinquent accounts.

Electricity in a Texas Office Building

The Texas Company, producer of fuel and lubricating oils, has recently completed a handsome thirteen-story home-office building at Houston, Tex., the electrical features and projected flood lighting of which make the structure a landmark for many miles around. More than 1000 lamps are employed in the lighting of the offices, and since the company's office force works in three eight-hour shifts throughout the entire twenty-four hours, the building presents the appearance shown in the picture practically all night long. Five hundred of the interior-fixture sockets contain 150-watt units. In addition to the 200 hp. in motors which make up the



FLOOD LIGHTING OF NEW TEXAS COMPANY BUILDING, HOUSTON, TEX.

power load of the building, each room is equipped with a four-blade ceiling fan, making a total, with those in the hallways, of 275 fans. To connect the main office with the various refineries, reducing plants and pipe stations, the Texas Company operates a large wireless plant on its roof, besides a number of special telegraph and long-distance telephone lines. Central-station energy, purchased from the Houston Lighting & Power Company, is employed to operate the wireless equipment, as well as to supply the other motor and lighting loads, and Mr. D. A. Hegarty, general manager of the central-station company, estimates the energy consumption of the new building at 360,000 kw.-hr. per annum.

New Lamp-Posts Recommended for Milwaukee

In the ELECTRICAL WORLD June 26, 1915, appeared a short account of the street-lighting survey report rendered to the city of Milwaukee by Mr. Frank A. Vaughn of Vaughn, Meyer & Sweet. Much attention was given to the design of posts for the prismatic refractor globes specified, as practically nothing had been done at the time of the beginning of the survey in ornamental lamp standards fitted for the use of refractor globes. The Wisconsin chapter of the American Institute of Architects passed on the general appearance of the posts.

Figs. 1 and 2 show lamp standards intended for the business streets. A tubular steel post has been suggested, although there are alternative designs in reinforced concrete, should the use of concrete prove feasible as to cost. On the main business down-town streets the twin-lamp post shown in Figs. 1 and 2 is recommended. On such streets 1000-cp. gas-filled tungsten lamps, mounted 30 ft. above the walk, are suggested for each post, the posts to be placed opposite each other every 180 ft.

For outlying business streets the single-lamp type of posts shown in Figs. 1 and 2 is recommended, a 600-cp. lamp being suspended 22½ ft. above the walk and the posts spaced 180 ft. apart as on the down-town streets.

In the residence districts the lamps at street intersections will be suspended over the center of the street from a span wire. In such cases the suspension height recommended is 22½ ft. On blocks over 420 ft. in length an intermediate lamp-post at the curb (Fig. 3) midway of the block is recommended. Gas or electricity may be used, the electric lamp specified being a 100-cp. gas-filled tungsten. If gas is used, a new mantle giving 10 per cent more light than that specified for the corresponding size of electric lamp is required.

On streets in sections of a changing or transitory character it is recommended that a 400-cp. lamp be suspended over the middle of the roadway at a height of 22½ ft., with a spacing of 360 ft. between lamps, thus permitting intermediate lamps to be placed later on the standard 180-ft. spacing used on business streets.

In designing the posts it was necessary to provide an artistic housing or holder for a series tungsten lamps equipped with a prismatic refractor globe. A new refractor globe is recommended, giving maximum candle-power about 65 deg. from the vertical instead of the 80 deg. maximum heretofore common with this type of globe. This is for the purpose of confining most of the light flux to the street near the lamp and avoiding the blinding effect of distant lamps.

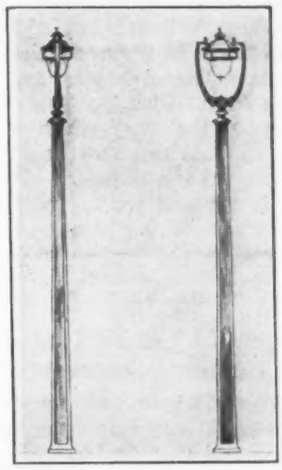
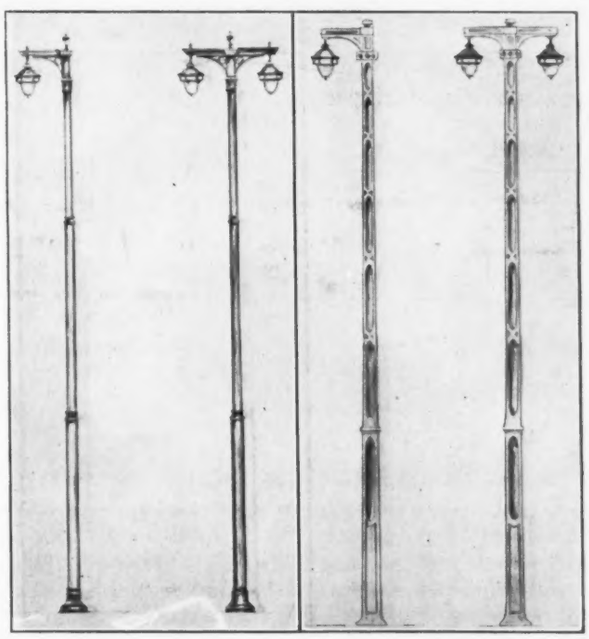


FIG. 3—POST RECOMMENDED FOR RESIDENCE DISTRICTS

With the report the engineer submitted an atlas of the city showing the exact location of each lamp-post, 8500 in all, the street obstructions, the existing poles to be encountered, and the character of the buildings along the street.

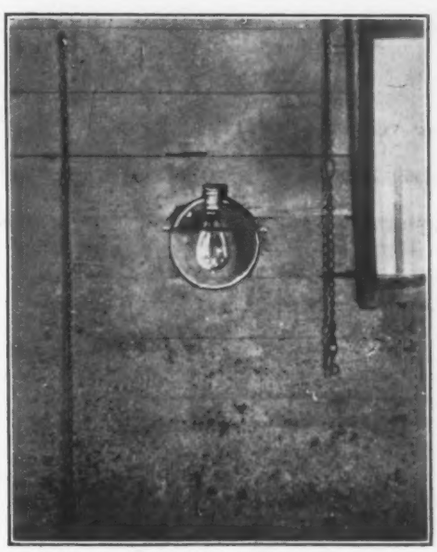
The general plan of electrical supply recommended is to place constant-potential transformers controlled by automatic time switches at various points and from these to run series circuits with transformers or compensators at each lamp.



FIGS. 1 AND 2—TYPES OF STEEL POSTS RECOMMENDED FOR THE BUSINESS DISTRICT OF MILWAUKEE

Practical Lighting in a Blacksmith Shop

A simple but effective arrangement for lighting the processes of horseshoeing, devised by Mr. Fred E. Sawyer of the Salem (Mass.) Electric Lighting Company, is installed in the blacksmith shop of Mr. J. W. McLean at Salem. Three round openings, 9.5 in. in diameter, were sawed in the inside boarding of the double-wall



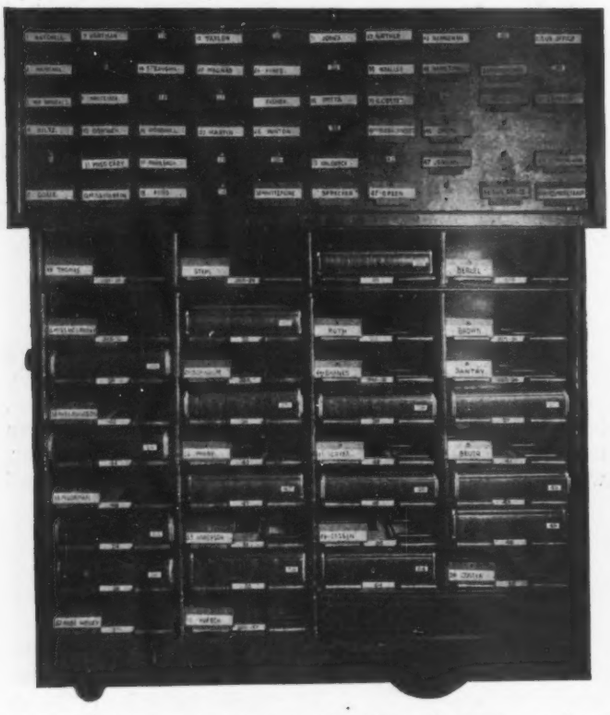
COUNTERSUNK HORSESHOER'S LAMP IN A SALEM BLACKSMITH SHOP

partition, leaving a space the depth of the joists, about 4 in. In each of these openings there was then placed and secured a concave metal shade 3½ in. deep, painted white inside, with a 25-watt tungsten lamp installed vertically in the center of the shade. A ⅜-in. steel rod was screwed to the woodwork, spanning the center of the shade and acting as a protection to the lamp against pressure of the horse's body.

The three units are in a row in the same side wall, spaced 7 ft. 6 in. between centers, and at a height of 32 in. above the floor. This location permits the light to shine directly on the work while the blacksmith is hammering the shoe on the hoof held on his knee. It is a ready solution of the difficulty of securing proper lighting for this sort of work, and does away with pendent flexible cords, which have been found to be in the way of the workmen.

Index to Ledgers in Use Facilitates Making Out Duplicate Statements

Customers do not like to wait long for a duplicate statement to be made out when paying a bill. They become impatient and may find occasion to harbor up a grievance against the company. To avoid tedious delay in finding statements the Consolidated Gas, Elec-



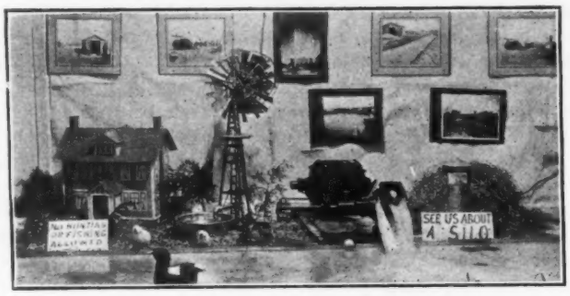
LEDGER RACK SHOWING BY MEANS OF LABELED BLOCKS THE LOCATIONS OF LEDGERS IN USE

tric Light & Power Company of Baltimore, Md., has installed an "Index to Ledgers in Use." If the ledger containing the account is not in its place, the clerk will find there, instead, a wooden frame on which is printed the name of the employee who has that particular ledger. The receiving clerk can thus immediately locate any ledger.

The accompanying illustration shows this convenient ledger index in use. Where a ledger is missing it will be noticed that a frame is in its place. Above are seen the frames not in use. Each employee has his own frame with which he replaces any ledger he takes from the rack.

An Electric-Irrigation Window Display

With the advent of the merchant spirit into the sale of electrical apparatus and motors, one can look for an increasing number of realistic window displays. In the accompanying illustration is shown such a display set



A SHOW WINDOW DESIGNED TO CATCH THE FARMER'S EYE

up by Carter Brothers, general hardware merchants at Garden City, Kan. A 0.25-hp electric motor operated the centrifugal pump which lifted water from the tank in the foreground, delivering it to the discharge line. The windmill, at the left, was operated by an electric fan. Goldfish swimming in the tank, and grass and evergreen branches, to represent trees on the banks, added to the attractiveness of the display. The pictures in the background showed irrigation plants in operation in the neighboring territory.

An Unintentional Demonstration of Electrical Appliances

An excellent demonstration of the operation and convenience of electric heating and cooking devices was afforded at a recent informal dance of the Elizabeth (N. J.) Lodge of the Order of Elks. To lend a touch of novelty to the affair, it was suggested that in place of the usual prosaic lunch served in the customary style, the various members of the party bring their electrical cooking appliances and cook and serve the refreshments around the table. Toasting racks, coffee percolators, chafing dishes and other devices were furnished by the

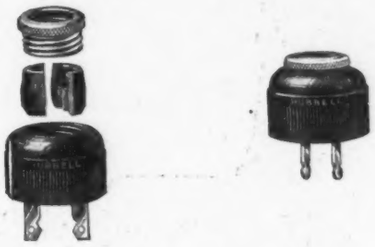
EACH GUEST HIS OWN COOK AT THIS ELECTRIC LUNCHEON

participants, and they and their guests prepared a lunch of club sandwiches, toast, coffee and creamed chicken, "cooked while they waited." Incidentally those guests and members who did not own electric heating and cooking appliances received an excellent demonstration of their convenience and adaptability.

NEW APPARATUS AND APPLIANCES

Plug Caps

The plug caps illustrated herewith have recently been developed by Harvey Hubbell, Inc., Bridgeport, Conn., and differ in design from other caps made by the above company, in the arrangement of the strain relief. A



PLUG CAPS WITH SPLIT BUSHINGS

brass threaded ring swivels around a split bushing, threading into a female depression in the top of the cap. The split bushing is securely clamped to the cord without twisting it, and eliminates the possibility, it is declared, of the wire being accidentally withdrawn from the binding post. If so desired, either of the caps may be equipped with a special strain-relief bushing to accommodate armored cable. Both caps are interchangeable with various types of wall and flush receptacles equipped with T slots made by the above manufacturer.

Electrically Operated Churn

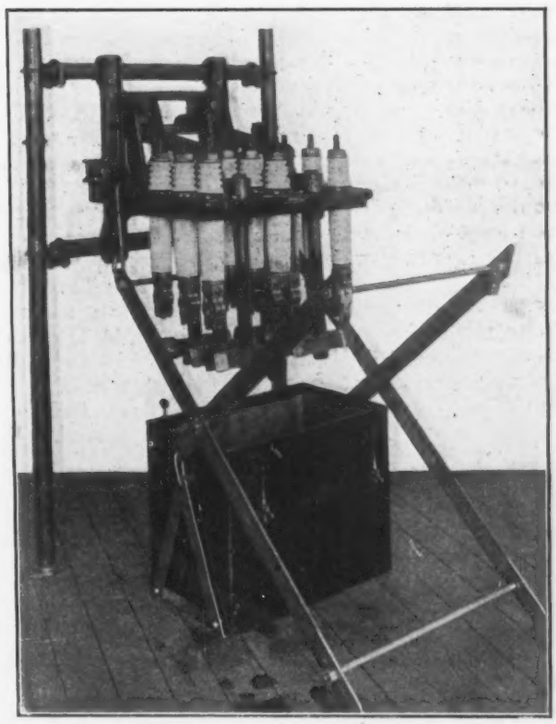
The churn illustrated herewith is operated by a 0.25-hp. motor which is connected by belt to a shaft at the bottom of the machine. Another belt on the other side of the machine leads to a shaft which operates the

MOTOR-DRIVEN CHURN

dasher through miter gears. The motor pulley is 2 in. in diameter and the shaft pulley in the base on the motor side is 7.5 in. in diameter; the small pulley on the opposite end of the shaft is 3 in. in diameter. The motor operates at a speed of 1750 r.p.m., giving a maximum speed to the dasher of 280 r.p.m. By shifting the belt between the tight and loose pulleys the speed can be varied. The dasher is of wood and can be moved up or down, depending on the amount of cream to be churned. The churn has a capacity of 28 gal. and weighs 125 lb. It is being placed on the market by the Dazey Churn & Manufacturing Company, St. Louis, Mo.

Tank Lifters for Small Oil-Switches

Oil-switch-tank lifters are very convenient, particularly in stations where a large number of switches are installed, and although a tank filled with oil for a comparatively small switch is not especially heavy, the character of the load makes it somewhat cumbersome for one man to manage. As a result the inspection of the oil-switch contacts may not be so regular as it should be to insure the most satisfactory operation.



OIL-TANK LIFTER FOR SMALL-SIZED OIL SWITCH

The tank-lifting arrangement manufactured by the General Electric Company, Schenectady, N. Y., provides means for quickly lifting an oil-switch tank either up or down the entire distance between the switch frame and the floor.

To fasten the tank lifter to the switch frame and lower the tank, two hooks attached to the inner ends of the longer pair of operating arms are placed over the ribs of the switch frame, the operating arms are raised and the tank supports are fitted under the tank. Then the wing-nuts that secure the tank to the frame are turned to unfasten the tank, and the arms are lowered to the floor. Finally two catches on the cross rod between the inner set of operating arms are released, and the arms are raised until the tank reaches the floor.

The tank supports are separate from each other and attached to the tank by continuations of the two equal sides of each strap-iron triangle, which are bent upward to fit over the rim on the bottom of the tank.

Each support is removed from the tank by lifting an end of the tank a few inches from the floor and sliding the support from underneath. To place the tank on the oil switch, the operation above described is reversed.

1916 Model Electrical Equipment for Automobiles

To its electrical apparatus for 1916 for gasoline automobiles the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has added a round-type starting motor and lighting generator, in the design of which, it is claimed, both reduction in weight and increased compactness have been obtained.

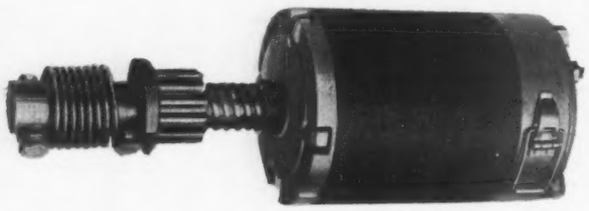


FIG. 1—MOTOR WITH SCREW SHIFT, HOUSING REMOVED

Several methods of pinion shift are available with the new units. In Fig. 1 is shown a round motor with an automatic screw shift which can be arranged for either inboard or outboard mounting. When the motor is at rest the pinion is entirely away from the flywheel gear. The threaded shaft is connected to the reduction-gear shaft by a spring which forms a flexible coupling. As the load is not large enough to compress the spring when the motor starts, the threaded shaft is immediately revolved by the spring in its released position. The pinion moves out on its shaft by means of the revolving threads until it reaches the flywheel. If the teeth of the pinion and flywheel meet instead of meshing, the spring allows the pinion to revolve until it meshes with the flywheel.

Another form of shift is operated by an electromagnetic device mounted directly on the motor and operating through a hollow shaft as shown in Fig. 2. When the starting switch is closed the circuit is completed through the switch and the shifting magnet and the motor, which is of the series type. The motor takes a relatively larger amount of energy at starting, but the shifting magnet is energized sufficiently to overcome the force of the return spring and draws the shifting rod through the shaft, thus sliding the revolving pinion into mesh with the gears on the flywheel. Diagonal teeth are used on the flywheel and the pinion so that they mesh very easily. When the pinion meshes with the flywheel gear the energy required to turn the engine over is sufficient to hold the pinion in mesh until the engine fires, but as soon as the engine "picks up" and tends to drive the motor, the amount of energy supplied to the motor falls off immediately, and the return spring of the pinion shift throws the pinion out of mesh to its original position.

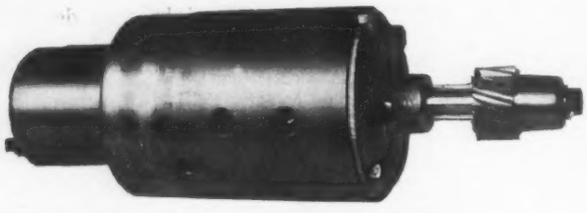


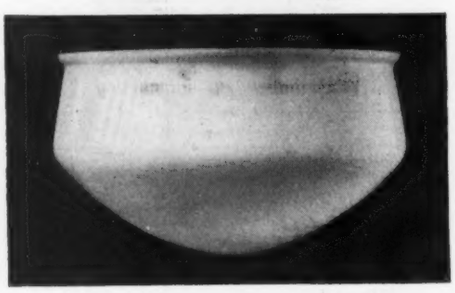
FIG. 2—MOTOR WITH ELECTRO-MAGNETIC SHIFT

The round-type generators can be provided with or without ignition as desired, and they may be operated by chain or gear drive from the engine. In Fig. 3 is illustrated a complete generator with vertical ignition apparatus. When the engine is not running, or is operating at very low speed, the lighting circuit is connected to the battery. At a predetermined speed the generator is cut in on the battery circuit by a separately mounted regulator and the generator supplies some of the energy used by the lamps or begins to charge the battery if the lamps are not turned on. On further increase of speed the voltage rise and the battery-charging current are controlled by the automatic voltage regulator. The voltage regulator is utilized to disconnect the generator from the circuit at speeds below that at which the energy is generated for the battery and to maintain constant potential at all speeds above the "cut-in" speed. The regulator is a small and compact device and is generally mounted on the back of the dash.

FIG. 3—GENERATOR COMPLETE, WITH VERTICAL IGNITION APPARATUS

Glass for Producing Daylight Conditions

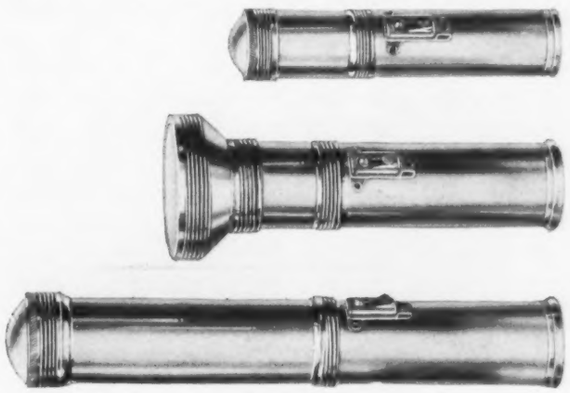
A new kind of glassware has been brought out by the Gleason-Tiebout Glass Company, 71 West Twenty-third Street, New York, for showroom lighting units where daylight conditions are desirable. The material is called "celestialite," and a unit made of it is shown herewith. The glassware was developed especially for James G. Johnson & Company, New York, wholesale milliners.



LIGHTING UNIT FOR PRODUCING DAYLIGHT CONDITIONS

Telescopic Tubular Flashlamp

Several types of tubular flashlamps have recently been developed by the Usona Manufacturing Company, 1 Hudson Street, New York, the lower pieces of which telescope the upper portions near the center. In each instance the case is drawn from solid-sheet brass. The lens is secured by a separate screw and ring, so that a



TUBULAR FLASHLAMPS

broken lens can be replaced without procuring an entire new head. The flashlamps are being made in five different sizes. They may be finished in heavy polished nickel, gunmetal or statuary bronze.

Device for Protecting Polyphase-Motors Against Phase Failure and Phase Reversal

Accidental rotation of a motor in a direction opposite to that which the operator is expecting may often cause serious trouble. With polyphase motors such action may result from reversal of the phases. Failure of one phase may also cause the motor to break down. A compact phase-failure relay, which is shown in the accompanying

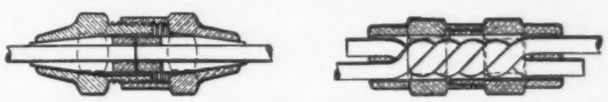
DEVICE FOR PROTECTING ALTERNATING-CURRENT MOTORS AGAINST PHASE FAILURE AND PHASE REVERSAL

illustration, has recently been developed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The device is designed especially for vertical motors having two-phase or three-phase stator windings and squirrel-cage rotor windings. The rotor shaft of a motor equipped for the device is extended at the top, and to the extension a casting is secured carrying contacts designed to close a pilot circuit which controls the motor starter. The phase-failure relay provides against abnormal drop in voltage, against failure of one of the phases, and against reversal of the phases. If the voltage falls below about 70 per cent of normal the relay opens the control circuit of the motor controller, and keeps it open until the line voltage returns to at least 85 per cent of normal. These limits can be adjusted to suit special conditions.

In case of phase failure, caused by the opening of one of the supply lines at any point, the manufacturer points out that the relay opens the control circuit if the motor is under appreciable load, and keeps it open until the fault is corrected. If the load on the motor is very light, so that no harm would result from its running single phase on account of the phase failure, the device may not operate until the load is increased or the motor shut down. If the motor is at rest at the time of phase failure the relay will act immediately. In case of phase reversal the relay is designed to open the control circuit immediately and keep it open until the phases are reconnected in the proper order.

Cable Connectors

Several types of cable-connecting devices, classified by the maker, the Fargo Manufacturing Company, Poughkeepsie, N. Y., into two groups designated as types A and B, are shown in the accompanying illustrations. The connecting devices in group A are of the compression type, that shown in Fig. 1 gripping the ends of the cables together and that illustrated in Fig. 4 pressing the end of one cable against the side of the other and so making a T-connection. With the type B connectors, the cables are passed through the end of a pair of hollow couplings, which are then screwed to-



FIGS. 1 AND 2—SECTIONAL VIEWS OF COMPRESSION AND TWISTED-CABLE CONNECTORS

gether, the cables being twisted and pressed longitudinally as shown in Figs. 2 and 5.

With the compression-type connector illustrated in Fig. 1 two couplings or sleeves, male and female, and two gripping cones, having composition ends where they butt together, are utilized. The cable ends which are to be connected pass through the gripping cones, and when the couplings are screwed together the grips are wedged against the cables. At the same time they are drawn toward each other, so that the cable ends can be pressed against each other as tightly as desired. When the couplings are unscrewed the joint is broken and the cable ends are separated, but unless a wrench

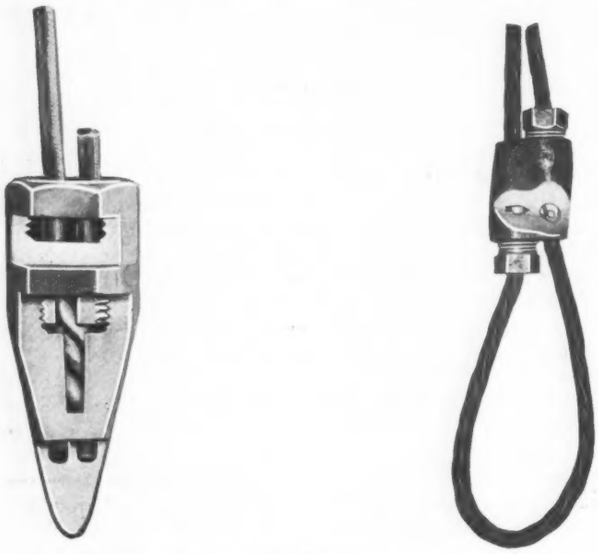
FIG. 3—GRIPPING CONE

is used it is declared that the joint has all the strength and conductivity of a weld.

According to the manufacturer, the type A connections can be used not only for conductors but also for guy wires, span wires, etc. The same general principle

of connection can also be applied to cable lugs, busbar connections, guy terminals with bolts that thread into dead-ending insulators, terminal connections, ground points and Y, L and T connectors. A T-connector is shown in Fig. 4 and a cable grip of the compression type in Fig. 6. With the latter connector the gripping cones are set side by side in a single casting, the pressure on the cable being applied by stuffing boxes which are screwed against the ends of the gripping cones. Another form consists of a guy grip especially adapted for span wires; in this type a bail is passed through the casting which takes the place of the male half of the coupling for the straight cable connection. In Fig. 7 is shown a cable connector of the double-grip form. In this type four gripping cones are employed.

FIG. 4—SECTIONAL VIEW OF "T" COMPRESSION CONNECTOR



FIGS. 5 AND 6—GROUND-POINT AND CABLE-GRIP CONNECTORS

FIG. 7—DOUBLE-GRIP COMPRESSION-TYPE CONNECTOR

In Fig. 5 is shown a ground-point connection of the B type. This type of connection can also be employed in a variety of forms.

Mercury-Arc Rectifier for Charging Small Batteries

A mercury-arc rectifier has just been developed by the General Electric Company, Schenectady, N. Y., for charging small storage batteries, such as are used for the starting, lighting and ignition of gasoline automobiles and motor boats, operating electric bells, electroplating, etc., where currents of 5 amp. or less and pressures up to 15 volts are desired.

The rectifier consists of a metal base, on which are mounted the necessary reactance coils and the rectifier tube which has a most suitable cover, the entire apparatus being incased in a perforated sheet metal covering. It is designed for charging one three-cell, one six-cell or two three-cell batteries as required, and is automatic in that it is self-adjusting to any of these three conditions. According to the manufacturer the unit may be connected to a single-cell battery and will charge it at the rate of approximately 6 amp. from a 110-volt alternating-current circuit.

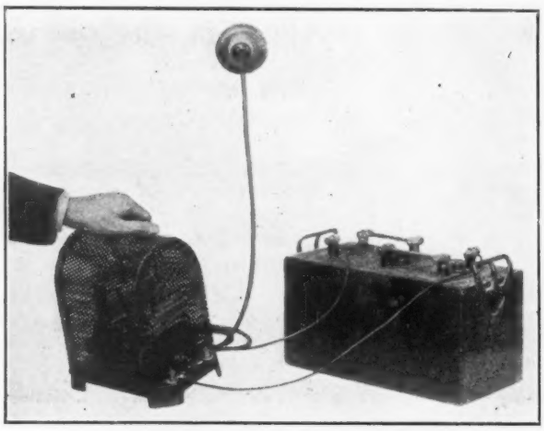


FIG. 1—RECTIFIER CHARGING A LIGHTING BATTERY

Rectifiers of the above type are being made for sixty-cycle, fifty-cycle, forty-cycle, thirty-cycle or twenty-five-cycle 110-volt circuits. The outfit is quite compact, the outside dimensions being 6.5 in. wide, 9.5 in. deep and 11 in. high. The total weight of the sixty-cycle rectifier is approximately 15 lb.

The rectifier is completely self-contained and is so designed that it will maintain a fairly constant current as the voltage of the battery rises. It is started by screwing the flexible-lead attaching plug into any convenient alternating-current lamp socket and connecting the two binding posts, distinctly marked (+) and minus (—), to the corresponding terminals of the battery to be charged. After the alternating-current supply has been turned on by the socket switch, the rectifier should be tipped slightly by means of the handle on the top. Where two batteries are to be used they should be connected in series and the terminals from the rectifier attached to outside posts of the two batteries.

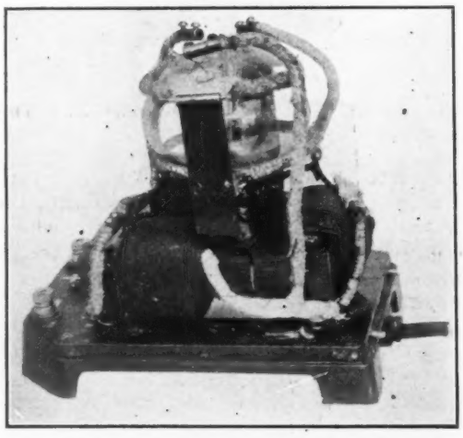


FIG. 2—MERCURY-ARC RECTIFIER CHARGING IGNITION BATTERIES

CURRENT NEWS SECTION

Electrical Code and License Law for New York

On July 6, the New York Board of Aldermen passed an electrical code for the city of New York, which, in addition to giving rules covering electrical construction, provides for the licensing of all persons or firms engaged in the electric-wiring business. All such persons must be examined by a license board consisting of seven members. If found competent, they may engage in the contracting business upon payment of a fee of $10 for the first year and $5 for each subsequent year. Special licenses granting a person in the employ of an owner or manager of a building permission to install, alter or repair electrical work are obtainable after examination upon the payment of $1. Permits for performing individual pieces of work are obtainable in the same manner. Provision is also made for the inspection of all electrical installation by the city, which has the privilege of revoking, modifying or suspending its certificates of inspection.

The rules as laid down in the code apply to all kinds of electrical construction with the exception of electrical equipment used in connection with railroads and by central-station companies, provided the electrical equipment in the latter case is loaned or leased and operated by, or for the exclusive benefit of persons or corporations subject to the jurisdiction of either of the Public Service Commissions of New York or their successors. The code as adopted, therefore, omits all reference to railroad construction, pole-line construction, etc. It follows the general arrangement and system of numbering employed in the National Electrical Code, with the exception that the classes of rules designated in the National Electrical Code as A, B, C, D and E are designated in the New York code by the numbers 200, 300, 400, 500 and 600. On page 1339 of the ELECTRICAL WORLD for May 22 the principal points in which the New York code differs from the 1913 edition of the National Electrical Code were stated.

Showing the Public What Water-Power Development Means

To stimulate local interest in the available water powers of the Chippewa Valley of Wisconsin, the Wisconsin-Minnesota Light & Power Company, which operates the largest hydroelectric enterprises in the district, and controls also large undeveloped resources on the Chippewa, Red Cedar and Flambeau Rivers, has undertaken, with the co-operation of local newspapers, a campaign of education. This is designed to reveal to the public the extent of Wisconsin water powers, the foundation of industries based upon them in the period preceding hydroelectric development, the history of the early work in such development, the personnel and characteristics of some of the pioneers, and the present and prospective industrial possibilities of the Chippewa Valley as its people apply the energy already developed and to be developed in the upbuilding of industry.

The purpose is to help the public to have an intelligent and pleasant appreciation of the importance of the natural resources made available for their uses by the hydroelectric enterprises. This is being done in the belief that the people may organize industries to use these resources and thereby build up diversified industries in cities and villages whose life heretofore has been dependent in whole or in part upon the lumber industry. The lumber industry appears now to have passed the summit of its importance in that district, and diversification of industries in the future is desirable for permanent prosperity. The publication of the articles has been arranged with the interested co-operation of the publishers and editors of the daily and weekly press of the district.

Electric Street Lamps Supplanting Gas in New York

The extent to which electric lamps are supplanting gas lamps in New York has been brought out by a controversy over the contract for the older type of illuminant. A letter was written to Mayor Mitchel by Mr. Frank Reese Greene, attorney, representing the Public Lighting Service Corporation, requesting him to investigate the action of Commissioner Williams of the Department of water supply, gas and electricity in rejecting bids offered by his company for the contract to furnish gas lamps and equipment for Manhattan during the present year. For sixteen years the contracts have been awarded to the Welsbach Street Lighting Company of America.

Commissioner Williams replied that the first two bids of the corporation were rejected because it declined to give the department necessary information as to its financial responsibility. The company furnished the information to a representative of the Board of Estimate and Apportionment last May, and the department was thereupon prepared to award the contract to it as the low bidder, but in the meantime conditions had changed. Mr. Williams adds:

"For the relatively inefficient gas lamp electric lamps are being widely substituted all over Manhattan. In place of 10,000 gas lamps, the number at the beginning of 1915, it is estimated that by the end of the year there will be fewer than 3000. Under date of June 28 the Corporation Counsel advised the department that in view of this changed condition it would be improper to award the contract to either of the bidders."

"Get Acquainted" Trip of Idaho Commission

The "get acquainted" trip of the Idaho Public Utility Commission was to have been started on July 8. In planning an itinerary covering the Southern and Eastern part of the State the commissioners had the hope that they would bring their work closer to the people. They will confer with the people regarding their wants and complaints against public utilities or common carriers. A similar trip was made over the Northern part of the State and proved to be of great benefit. President Axel P. Hamstedt and Commissioners A. L. Freehafer and John W. Graham planned to make the trip.

The itinerary extended from July 8 to July 25 and covered Gooding, Wendell, Jerome, Buhl, Twin Falls, Minidoka, Burley, Rupert, Blackfoot, Mackay, Idaho Falls, St. Anthony, and Ashton. The commission will investigate various matters and hold a number of hearings.

Water Rights in Idaho Case

The order issued by the Idaho Public Utility Commission requiring the Pocatello Water Company to make certain improvements at an approximate cost of $100,000 has been reversed by the Idaho Supreme Court in a decision in the case of Mr. James A. Murray vs. the commission, asking for a review of the commission finding. The case was remanded to the commission with instructions to take further evidence. Judge Charles P. McCarthy wrote the opinion, which was concurred in by his associates. The commission employed Mr. A. J. Wiley to make an engineering examination and Mr. H. H. Miller, its auditor, to audit the accounts. The case was taken before the commission originally on the application of the company to increase rates. The city of Pocatello intervened. From the commission's order directing the improvements to be made Mr. James A. Murray, owner of the company, applied to the Supreme Court for review.

The court held that the commission should have considered the water rights of the company at the present value and that certain expenses incurred by the owner of a public utility shall be considered by the commission in fixing a value on the utility, for it is a going concern which is being operated successfully. The cost of reproduction less depreciation is held to be the basis the commission should adopt in attempting to fix rates. It is also held that the commission erred in not taking into consideration the personal property values of Mr. Murray in horses, equipment, etc., at the reservoir.

Effect of Duluth Rate Reduction

In discussing the effect of the outcome of the recent municipal ownership controversy on the earnings of the Duluth Edison Electric Company, Mr. A. W. Hartman, the president, informs preferred stockholders that a successful new-business campaign has been undertaken.

For the last two or more years, Mr. Hartman says, there has been considerable agitation in Duluth looking to the entrance by the city into the electric light and motor-service business, either in competition with the company, or through the purchase and operation of the company property. The agitation for municipal ownership culminated in 1914, when an ordinance was passed appropriating $85,000 with which to build the first unit of an electric plant to supply both municipal and commercial service. Under this plan energy was to have been purchased by the city from the Great Northern Power Company, and additional units were to be established gradually as they were needed. This ordinance, however, did not meet with the approval of a large number of the more influential citizens of Duluth.

To adjust the questions at issue, and at the request of a citizens' committee organized to investigate the merits of the controversy, the company agreed to make a two-year contract with the city to supply arc lighting at $45 a year per lamp instead of $55, the price then in force, and also to reduce the existing lighting rate from a maximum of 8 cents per kw.-hr. to 6 cents. The City Council, notwithstanding the urging of the citizens' committee, refused to negotiate with the company, and instead adopted an ordinance providing for a maximum rate of 4 cents per kw.-hr. The three propositions were left to the decision of voters, and at a special election in January of this year the proposals of the city were defeated and that of the company was adopted. The reduction in rates went into effect as of Jan. 1, 1915.

Mr. Hartman adds: "The 6-cent maximum lighting rate, which is the lowest rate for similar service in any city in this country, has reduced the earnings of your company materially, while the operating expenses have been increased, due to the necessity for charging off the cost of legal and engineering expenses in connection with the municipal ownership agitation. In order to offset the reduced earnings as much as possible, a vigorous new-business campaign was undertaken. It is gratifying to note that this has resulted in the obtaining of a considerable amount of new business. A further improvement in earnings is expected as a result of generally improved business conditions in Duluth."

Electric Railway Energy Contract in California

The San Francisco-Oakland Terminal Railways and the Consolidated Electric Company, San Francisco, which was formed to take over the properties of the United Light & Power Company, have filed their proposed new contract with the California Railroad Commission, under the terms of which the Consolidated company will sell energy to the Key Route division of the railways, at the rate of 0.095 cent per kw.-hr. The contract will extend for seven and one-half years, terminating on Dec. 31, 1922. Heretofore the Key Route division has been supplied by the United Light & Power Company under the terms of contracts entered into during the latter part of 1911 and the early part of 1912. In a recent decision the commission found that the rate was excessive and unreasonable. With the present arrangement, the United Light & Power Company leases for a nominal sum the steam plant station owned by the railways. Under the new agreement the lease on the steam plant will be cancelled and the possession of the plant returned to the railways on Aug. 1, 1915. The new contract reduces substantially the price which the Key Route division will pay for energy.

Modern Fire Alarm System for New York

The Board of Estimate and Apportionment of New York has approved the request of Fire Commissioner Robert Adamson for an appropriation of $991,497 for the installation of a modern fire alarm system for Manhattan Island. This problem has been discussed a good deal for several years.

Mr. Putnam A. Bates, electrical engineer and chief of the Bureau of Fire Alarm Telegraph, states that the undertaking comprises principally the purchase and installation of a comprehensive cable plant of the highest quality. In its character and scope it is essentially different from the cable plant of any other electrical system now in service. Thus far large cities, as in the case of New York, have grown into their equipment by adding extensions to early installations not planned for the ultimate work. In the preparation of the present arrangement the principles of engineering as applied to this problem by Messrs. J. J. Carty and Kempster B. Miller in their preliminary plan prepared in 1907 have been adhered to closely. In the planning of the alterations to the central office building as well as the apparatus which it will house, it is intended that the same general character of equipment and method of installation shall be employed as was proposed then.

By discontinuing the use of the old fire department subways and also the high-tension subways of the Consolidated Electrical Telegraph & Subway Company and by confining the fire-alarm cables to the low-tension system of subways to be supplied by the Empire City Subway Company, the plan will eliminate to as great an extent as present-day conditions of such installations afford the possibility of contact between conductors of fire-alarm systems and foreign circuits containing dan-

gerous currents. With the new system the occurrence of grounds and open circuits should be rare and the immediate rectification of such faults being imperative, owing to the type of plant and central-station apparatus to be installed, the possibility that the system will become deteriorated again while it remains in service is eliminated.

Cincinnati Franchise Negotiations

The proposed ordinance drafted by the light committee of the City Council of Cincinnati, which has had its first reading, is designed to cover a period of ten years from Aug. 12, 1915. The rates named are 8½ cents per kw.-hr. for thirty hours' use per month of the maximum demand; 6½ cents per kw.-hr. for the next thirty-hours' use; 3½ cents per kw.-hr. for energy in excess of sixty hours' use. The rates shall be subject to revision by either of the parties at the expiration of five years provided that six months' written notice be given prior to the expiration of the five-year period. The companies, when less than 10 kw.-hr. are consumed in any one month, may charge for each kilowatt connected 75 cents as a maintenance charge. Where bills are not paid within five days the companies may make an additional charge not to exceed ½ cent per kw.-hr.

The rates shall include the supply by the companies without additional charge of such standard carbon filament incandescent lamps as may be required for lamp renewals. The companies shall furnish tungsten lamps at not exceeding cost. They shall, without charge, make extensions of overhead lines not to exceed 100 ft. where necessary to serve applicants. A violation of any of the sections shall be a misdemeanor and the companies or any officer or employee upon conviction shall be fined not to exceed $50.

At a meeting of the light committee of the Council on June 28 Mr. Arthur C. King of Chicago submitted by request a report as to what amount of reductions the tentative valuation of the Public Utilities Commission on the properties of the Union Gas & Electric Company and the Cincinnati Gas & Electric Company devoted to electric service would permit.

Mr. King reported that 8 per cent on the State commission's valuation would be $676,126; operating expense per annum, as shown by the King report, is $840,970; a 3½ per cent allowance for depreciation reserve on the State commission's valuation (excepting cost of attaching or developing business and preliminary organization and franchise expense and working capital) is $318,475; total $1,835,571. The gross net income from Cincinnati business, as shown by the King report, is $2,017,779. Deducting the total of $1,835,571 indicated, leaves a maximum reduction authorized by commission's valuation of $182,208.

Mr. King reports that on the proposed rate of 8½, 6½ and 3½ cents the following reductions in income are produced: Residence lighting, 9668 customers, $28,500 reduction; retail commercial, 8320 customers, $59,000 reduction; retail motor-service, 2074 customers, $18,600 reduction; wholesale light and motor-service, 427 customers, $45,900 reduction; lamp renewals, 18,215 customers, $53,050 reduction; total reduction, $205,050.

The indicated reduction of $205,050 includes, Mr. King adds, the proposed reduction in the minimum charge to 75 cents, but he did not figure the additional cost of wiring to the company, as this is impossible to do, for it is based upon prospective new customers. He said, however, that the retail motor-service rate is figured on a basis of 8½, 5½ and 2½ cent rates, for the proposed rates in some instances would cause these customers to pay more than the present rates now charged.

Summarizing his conclusions, Mr. King said that the State commission's valuation as a basis for rate-making permits a reduction of $182,000 per annum; his report as filed permits a reduction of $304,000 per annum; the sliding scale, as outlined, authorizes a reduction of $205,050.

At a meeting of the Council committee on light on July 3, Councilman Aull proposed an amendment that would compel the company, where a customer is dissatisfied, to install a test meter to determine the maximum amount of energy used. President W. W. Freeman informed him that a standard table for this purpose is in use all over the United States and that the installation of a test meter would mean an increase in rates. Councilman Conner's proposed amendment reducing the period of the franchise to five years was met with the assertion that rates may be revised at the end of five years. Councilman Aull raised a question as to the legality of a provision compelling the company to sell lamps at cost. President Freeman stated that he is not concerned in this, as the dealers will take care of it, for such a requirement would ruin their business. In regard to rates Mr. Freeman told the committee that a low, flat figure would result in an increase of rates of many consumers. Before the close of the meeting he made this statement:

"If you gentlemen are long on memories you will remember what I am telling you now. When the Public Utilities Commission fixes the valuation of our plant the present tentative rate submitted by the commission will be greatly increased. Values not reckoned with in the report just submitted will be added, and a greater rate than is contemplated in the ordinance now before you will be allowed by the State authorities.

"If the question of physical valuation would be the only matter to be determined I would not be here now to argue the point. You cannot jam any reductions you see fit down our throats because conditions do not warrant them. I again predict that when the matter is finally up before the State commission the valuation will be increased."

A conference of leading officials of the Columbia Gas & Electric Company and the Union Gas & Electric Company was held at Cincinnati, Ohio, on June 30, when plans for financing the proposed new central station were discussed. Among those present were Messrs. A. B. Leach, W. P. Phillips, P. G. Gossler, and officials of the local company.

The Public Utilities Commission has announced July 13 as the date for hearing the arguments of the company and the representatives of the city of Cincinnati on the valuation fixed on the company's electrical property.

Safety Results in Louisville

"Safety-first" work on the part of the Louisville Gas & Electric Company, careful attention to the fitness of employees for their posts, and other conditions have led the management of the Louisville Gas & Electric Company to decide to discontinue carrying liability insurance on everything except boilers. The policies will not be renewed when they expire early in July. The company has been paying annually for liability protection from $16,000 to $24,000, depending on the payroll.

With the "safety-first" work, however, accidents to employees and the public have been reduced by more than 50 per cent, and a serious accident is now rare. Announcement of the new policy was made by Mr. Donald McDonald, vice-president and general manager, at the June 21 meeting of the Employees' Club. Mr. McDonald asked the co-operation of the employees, and promised that the company would do its part by them.

Congestion in Sub-Surface Structures in New York

Mr. Charles N. Green, engineer of sub-surface structures for the New York Public Service Commission, First District, has called attention to the congestion in underground New York as a result of pipes, mains, conduits, cables and tubes. He declares that no systematic effort has been made to allot space underground and the result is that a great deal of senseless duplication has taken place. A report made by Mr. Green says: "In 500 miles of Manhattan streets there are 1450 miles of gas mains. As there are only about 800 miles of water mains, not including 100 miles of high-pressure mains, and as the requirements of the two services are similar, it would appear that there are 650 miles of unnecessary gas mains.

"The time has come when all structures not being used or not needed by growth should be removed by the owning company. This would leave more room for other necessary structures and reduce the cost of pavement. For the gas companies it would reduce the maintenance charge, the loss due to unaccounted-for gas, the fire and explosion hazard and the amount of investment on which a revenue must be earned.

"It would result in better pavements generally, less interference with business and traffic, fewer complaints, less leakage, easier and cheaper repairs to gas and water mains and all other subsurface structures."

Electrical Import Trade of Peru

The *London Electrical Review* publishes a table showing imports of electrical and allied goods by Peru during 1913 from Great Britain, Germany, France, United States, Belgium and other countries.

The value of electrical apparatus imported amounted to $230,000 as against $125,000 for the preceding year; $125,000 was sent from the United States, $75,000 from Germany, $10,000 from Great Britain, and the remaining $20,000 from other countries. Of the $40,000 of incandescent lamps imported $15,000 were from the United States and $25,000 from Germany. The United States furnished $20,000 copper cable, Germany $5,000, and other countries $2,500, totaling $27,500. Telegraph and telephone instruments and apparatus imports were divided between United States $5,000, Germany $2,500, and other countries $2,500. .

Of the $90,000 of railway and tramway cars, Great Britain sent $40,000, United States $37,500, and Belgium $12,500. The value of steam boiler imports in 1913 was $60,000, in comparison with $90,000 in 1912. Great Britain exported to Peru $25,000 of steam boilers, the United States $27,500, Belgium $5,000, and other countries the remaining $2,500.

Cleveland Municipal Plant Developments

According to a statement from Light and Heat Commissioner Ballard the $500,000 remaining from the $2,700,000 bonds already sold will not be sufficient to complete the extensions necessary to bring the Cleveland municipal plant to its full capacity. If any increase in the number of extensions and connections is demanded, he said, the money now on hand will not last until the end of the year. Connections are being made now at the rate of 700 a month and the plant is operating at one-third its rated capacity.

The Cleveland City Board of Control has refused to grant the union scale of wages to the twenty-three electricians employed on inside work at the municipal plant. A demand for an increase from $5 to $5.50 per day was made by the men.

Memphis to Buy Central Station Plant

Notice has been given by the city of Memphis, Tenn., to the Merchants' Power Company that it will exercise its option under the 1905 franchise to purchase the plant. The city had the right of purchase at the end of ten years on payment for the physical property. The Merchants' company has to accept or reject the city's offer in six months. If the city's terms are not satisfactory the purchase price is to be fixed by arbitration.

Engineers have reported to the city that the physical value of the plant is $684,000, cost of developing business $150,000, necessary repairs $189,000, distribution system for street lighting $300,000, cost of acquiring property and organization $100,000, total $1,423,000. In the last year the Merchants' Power Company showed sales of 8,258,838 kw.-hr., of which 7,937,358 kw.-hr. were for commercial use.

If the city acquires the property in accordance with its present plan, it will compete with the Memphis Consolidated Gas & Electric Company. The franchise of the Memphis Consolidated Gas & Electric Company stipulates that if a rival company shall extend its service to as much as 25 miles the rate of the company, if lower than 10 cents per kw.-hr., shall be met by the Consolidated company.

Messrs. Ralph Rumery and R. D. Bacon of New York, who examined the plant in connection with the consideration by the city of the question whether it should acquire the property or construct an entirely new system, favored the purchase of the Merchants' system if the city entered the commercial field, but suggested a new system if it undertook only street lighting.

Pacific Coast Managers on Heating Loads

Immediately following the N. E. L. A. convention in San Francisco, representatives of several of the central-station companies operating in the Western States, together with representatives of some of the manufacturers of cooking devices, met in the St. Francis Hotel, San Francisco, on the morning of June 12 for the purpose of devising ways and means to promote a more extended use of energy-consuming devices.

Mr. M. C. Osborn, commercial agent of the Washington Water Power Company of Spokane, acted as chairman of the meeting. It was deemed inadvisable to hold a special meeting in the near future for the discussion of the matter in hand, but it was determined to have as many representatives of the various Western companies as possible attend the approaching convention of the Northwest Electric Light & Power Association, at Portland, in September. A committee consisting of Messrs. W. R. Putnam, sales manager of the Utah Power & Light Company of Salt Lake City, S. V. Walton, manager of the commercial department of the Pacific Gas & Electric Company of San Francisco, and M. C. Osborn was appointed to get data from the various companies and present a report at the Portland convention.

It was the opinion of those attending the meeting that the situation as far as lamp socket devices are concerned is being very well handled, and that the particular problem now has to do with electric ranges, water heaters and other heating devices that are not used on lamp sockets. A number of important matters will be brought up at the Portland convention by the committee, including cost of connecting ranges and serving them, policy of charging consumers for portion of the installation cost, diversity-factor of cooking load, rates to be charged, water-heater problems, revenue from cooking and heating business, policy of companies in merchandising, and publicity policy.

Government Seizes Sayville Wireless Plant

By order of the President the wireless plant at Sayville, L. I., which is owned by the Atlantic Communication Company, a subsidiary of the Telefunken Company of Germany, was seized Thursday morning and will hereafter be operated by the United States Navy Department. This follows reports that the station has been used for purposes which violate the neutrality of the United States. The Sayville plant will be operated by the Navy Department on the same plan which is followed in the case of the station at Tuckerton, N. J. Operation under these rules will mean that the plant will be used only for transmission to and receipt from shore stations in United Kingdom and Continental Europe. It will not be allowed to send messages to belligerent ships at sea. Non-neutral messages will not be permitted and cipher or code messages will be refused unless the United States representatives have a key enabling them to interpret the messages. Messages in foreign languages or unintelligible terms will not be transmitted or received unless the government officials in charge are furnished translations and are thoroughly satisfied as to the nature of the messages.

Trade Commission Hearings on Export Business

Following the hearings of the Federal Trade Commission in New York and Boston on the question of whether or not American manufacturers should be permitted to form combinations in the interest of foreign trade, the commission will hear similar testimony in other cities. The itinerary provides for visits to Detroit on July 21 and to Cincinnati on July 22. The commission will spend a week in Chicago beginning on July 26. After concluding its investigations there the commission will go West, visiting Minneapolis, Seattle, Portland, Ore., Spokane, San Francisco, Los Angeles and San Diego. On the return trip to the East a hearing will be held in New Orleans. Other Southwestern and Southern cities will be visited and the commission will make every effort to learn the sentiment of exporters and manufacturers who will be affected by whatever action is taken by Congress.

Rules of practice before the Federal Trade Commission were adopted on June 17. While the principal office is at Washington, the commission may meet and exercise all its powers at any other place and may, by one or more of its members or by examiners, prosecute any necessary inquiry in any part of the United States. Sessions for hearing contested proceedings will be held as ordered by the commission. Sessions for the purpose of making orders and the transaction of other business, unless otherwise ordered, will be held at the Washington office on each business day at 10.30 a. m. Three members shall constitute a quorum.

Any person, partnership, corporation or association may apply to institute a proceeding in respect to any violation of law over which the commission has jurisdiction. The application shall be in writing, signed by or in behalf of the applicant, and shall contain a short and simple statement of the facts constituting the alleged violation. The commission shall investigate, and if it shall appear that there is a violation of law over which the commission has jurisdiction, it shall serve a complaint with notice of a hearing at least forty days thereafter. Within thirty days from the service of the complaint, unless the time be extended by commission order, the defendant shall file an answer. The answer shall admit or deny or explain specifically each of the facts alleged unless the defendant is without knowledge, in which case he shall so state, the statement operating as a denial.

Any person, partnership, corporation or association desiring to intervene in a contested proceeding shall apply in writing. The commission may permit intervention by counsel or in person.

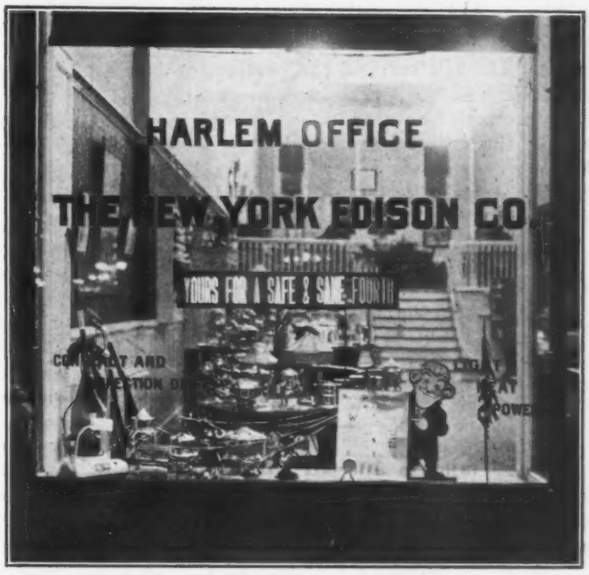
Fourth of July Advertising in New York

Show window advertising displays marked the observance of the Fourth of July by the New York Edison Company. The displays reproduced in accompanying photographs were planned by employees of the company and were submitted among many in a prize competition.

The "Safe and Sane" display is the work of Mr. Samuel H. Cleeland, Jr., of the lighting inspection bureau. This shows the "Edison Man" and his evident disgust

"SAFE AND SANE" DISPLAY

with the old-time Fourth of July devices. Two "Edison Men" have the solution for his faultfinding in the form of electric lamps for decorative purposes. Miss K. M. Ash of the stenographic force suggested the "declaration of independence" display. This declaration is one



DECLARATION OF INDEPENDENCE THROUGH ELECTRICAL APPLIANCES

of independence from the drudgeries of housework with electrical energy pointing the way to freedom. The winners are not connected with the advertising work of the company, except as they took part incidentally in the contest which was open to all employees.

The displays occupied the windows of all of the company branch offices from the afternoon of July 2 until the morning of July 6.

Organization of West Virginia Public Utilities

Permanent organization of the Public Utilities Association of West Virginia, which includes electric central-stations, electric railways, and water works companies, was expected at a meeting held in Charleston on June 15 and 16. A constitution and by-laws were adopted and permanent officers elected as follows:

President, Mr. Herbert Markle, general manager, Appalachian Power Company, Bluefield; first vice-president, Mr. G. O. Nagle, general manager, Wheeling Traction Company; second vice-president, Mr. Mentor Hetzer, general manager, Moundsville Water Company; third vice-president, Mr. James Imboden, general manager, West Virginia Light & Traction Company; secretary and treasurer, Mr. W. C. Davis, vice-president, West Virginia Water & Electric Company; executive committee, Messrs. W. C. Mathews, president, Virginia-Western Power Company, Clifton Forge, Va.; Herbert Markle, general manager, Appalachian Power Company; G. O. Nagle, general manager, Wheeling Traction Company; Mentor Hetzer, general manager, Moundsville Water Company; O. B. Welch, vice-president and general manager, Williamson Light & Power Company; W. L. Foster, general manager, Beckley Electric Light & Power Company; H. S. Newton, general manager, Ohio Valley Electric Company, Huntington; E. W. Alexander, general manager, Charleston-Dunbar Traction Company, Charleston; W. A. Maxwell, general manager, Logan Heat, Light & Power Company.

The association will promote the interests of public utility companies along educational and political lines. Meetings will be held every June and fall.

Illinois Electrical Contractors' Summer Meeting

At the semi-annual meeting of the Electrical Contractors' Association of Illinois, held at Peoria, Ill., June 25 and 26, liability insurance was the chief topic of discussion. The contractors' association about eighteen months ago secured the services of Mr. E. J. Burns of Moline as its permanent secretary. At the same time a resolution was passed requiring each member to pay the association in addition to his regular dues 0.05 per cent of his gross business. Through the efforts of the secretary and the insurance committee, the association has been able to place the insurance of members economically. At the same time the association has secured a commission on all the insurance so placed, thus increasing its funds. In spite of these sources of income, however, the expenses of the association have been greater than its receipts. One cause of the deficit given is the business depression, which, it is declared, has materially reduced the 0.05 per cent special assessment that the members pay to the association.

A special finance committee, appointed to discover ways and means of reorganizing the association's finances, made arrangements with the Chicago members and a few others to pay dues in advance for the time being. The resignation of the permanent secretary, Mr. E. J. Burns, was accepted and it was decided to continue the payment of the special assessments until the association's finances are in better shape.

Election of officers resulted as follows: President, Mr. J. M. Pierce of Chicago; vice-president, Mr. John Hughes of Champaign; secretary-treasurer, Mr. M. Blumenthal of Chicago; directors to the National Electrical Contractors' Association, Messrs. J. T. Marron of Rock Island, Frank Decker of Chicago and E. C. Gibson of Decatur; and Illinois directors, Messrs. J. T. Marron of Rock Island, Guy Carlton of Bloomington and E. F. Pendergart of Rockford.

THE MICHIGAN CONVENTION CRUISE

State Section of the N.E.L.A. Combines Sightseeing with Profitable Discussion on Public Policy, Wiring and Lighting Topics

Holding its annual convention on board the Steamer Rochester, June 26 to 30, the Michigan Section of the National Electric Light Association cruised from Detroit through Lakes Ste. Claire, Huron, Superior and Michigan. Stops for sight-seeing trips ashore were made at Sault Ste. Marie and Mackinac Island, Mich.; Milwaukee, Wis., and Saugatuck and Grand Haven, Mich. The convention sessions were held on board the boat in the evenings as well as at other times when no particular objects of interest were in view to distract attention. About 135 members and guests, including thirty ladies, enjoyed the trip.

President Fee on Concentric Wiring

In his presidential address Mr. H. A. Fee of Adrian said: "While the concentric-wiring movement has failed of its full purpose because of the strenuous objections interposed by manufacturers who thought their interests were jeopardized by the new system, we can congratulate ourselves on the fact that tentative approval has been secured. This concentric-wiring episode has brought out very clearly the fact that central-station interests are not equitably represented on the joint committee constituted by the Underwriters, and it is only too evident that the situation is fraught with danger.

"It is my belief that we should stand strongly for the interests of our customers and for the healthy development of the industry, instead of assuming the narrower view of those manufacturers who feel that they may be injured by changes made in the course of development. I believe this so strongly that I advocate a testing bureau, operated by the N. E. L. A., and having for its function the determination of the fitness and desirability of the many electrical devices which are offered to our customers. A considerable portion of these devices are defective in design and in application, and yet we stand idly by and let our customers waste their money in purchasing them, or what is still worse we sometimes sell the devices ourselves. We do this in good faith, but we exercise poor judgment, with the result that the customer to a greater or less extent gets the idea that all electrical devices—and even our electric service—is unreliable. In the end this system is thoroughly disadvantageous to the central station."

Safety and Regulation

Mr. Fee also spoke of the fair-minded attitude which the Michigan Railroad Commission is taking in public-utility cases and expressed regret that legislative measures establishing more direct relations between the utilities and the commission had not been passed.

Speaking on "Safety," Mr. Dudley R. Kennedy, counsel of the Youngstown (Ohio) Sheet & Tube Company, urged emphatically that measures promulgated to insure greater industrial safety should be viewed as business propositions. Every safeguard installed, said he, brings its direct profit to the concern humane enough to employ it.

Mr. James V. Oxtoby of Detroit, in an address entitled "Recent Legal Discussions Influencing Public Utilities," reviewed interesting cases which have lately been decided in California, Wisconsin and North Dakota.

At an evening meeting talks of popular and interesting character were given by Mr. Evan J. Edwards of Cleveland, Ohio, and Mr. S. A. Freshney of Grand Rapids, Mich. With the aid of lantern slides Mr. Ed-

wards traced the progress of artificial lighting from its beginning to the present day. Mr. Freshney reviewed some of his pioneer experiences in the electrical business.

Uniform rates, gas-filled tungsten lamps, magnetite-arc lamps, and farm lines were the topics of discussion at a round-table meeting.

Comparative Cost of Magnetite-Arc and Nitrogen-Filled Tungsten Street-Lighting Units

The paper by Mr. J. H. Loban of the statistical department of the Edison Illuminating Company of Detroit, Mich., presented a comparison of the annual costs of operating the 4-amp. direct-current magnetite arc and the 600-cp., 20-amp. nitrogen-filled tungsten lamp, based on data obtained from the records of the Eastern Michigan Edison Company and from other sources. It was assumed, explained Mr. Loban, that the 600-cp. tungsten lamp would naturally be the one to replace the 4-amp. magnetite arc where changes from arc to incandescent lighting are being considered. The author also assumed a cost of energy at the generating station switchboard of 1 cent per kw.-hr.; the installation of 1000 ft. of No. 6 wire per lamp; 4000 hours of lamp operation per year, and a tungsten-lamp life of 1350 hours per renewal. The tungsten units considered employ a compensator for transforming the current. Allowance was also made, it was explained, for losses in transmission, in the compensators, in the constant-current transformers, and in the rectifying apparatus.

The author divided the annual cost under two main headings—running cost and fixed cost—as follows:

	Magnetite	Tungsten
Running costs:		
(a) Annual running cost per lamp for energy consumed	$16.90	$17.09
(b) Annual running cost per lamp for renewals, repairs, etc.	7.12	14.52
Fixed costs:		
(a) Annual fixed cost per lamp for transmitting power from generating station to substation, 2300-volt bus	8.90	9.00
(b) Annual fixed cost per lamp on investment in special street-lighting equipment	17.12	14.17
Total annual cost per lamp	$50.04	$54.78

Assuming that the lamps will have a life of 1350 hours, requiring three renewals per year, Mr. Loban pointed out that the principal differences between the running cost of the two classes of units lay in the cost of renewals of the tungsten lamps. These renewals alone amount to $9.45 per year, he said. The author emphasized that it was not his intention to enter into a technical comparison of the two types of lamps, since he expressed the belief that there could be no absolute standard for such a comparison where the public is concerned, with its individual likes and dislikes. He pointed out, however, that the 4-amp. magnetite lamp, with standard electrodes equipped for street-lighting service, produces approximately 2990 total lumens and with high-efficiency electrodes 4649 lumens, while the 600-cp., 20-amp. tungsten lamp, equipped for street-lighting service, averages about 4800 lumens.

The preceding figures on the magnetite arc are based on the use of standard electrodes. High-efficiency electrodes have a slightly shorter life and cost 3 cents more each. Figures based on high-efficiency electrodes show an increase in the annual cost of operation of approximately $1 more than the figure used. In other words, with an increase of 2.5 per cent in the annual cost of operation an increase of 55 per cent in the total lumens can be obtained. Reference was also made to the fact that a prismatic refractor is available for use with the tungsten unit, which gives a practically ideal distribution curve for street lighting. Such a refractor costs $3 and would require at least one and probably two replacements per year, which would make the annual cost of the tungsten unit higher than before. In general, concluded Mr. Loban, magnetite lamps are particularly adaptable to large installations, and tungsten lamps to small installations.

In closing, the author pointed out that besides total lumens there are other considerations which must be borne in mind. These are glare, brilliancy, color, steadiness, distribution, suitability of the unit for the particular location, and, last but not least, the attitude of the public toward the two kinds of illumination.

Discussion

Mr. H. A. Reid of Cleveland, in analyzing the data presented by Mr. Loban, pointed out the fact that the higher power factor of tungsten-lamp circuits and their correspondingly lower station demand had not been taken into consideration. Arc-lamp circuits of the type under discussion commonly operate, said he, at 65 per cent power factor, while tungsten-lamp circuits operate at 85 per cent. Mr. Reid also said that he did not think it necessary to use a 600-cp. lamp to displace a 4-amp. magnetite lamp, declaring that a 400-cp. unit under actual operating conditions would provide approximately the same effective illumination.

A statement made by Mr. Loban to the effect that refractors would "require at least one and perhaps two replacements per year" was also challenged. Although experience with refractors has been limited to a little more than a year, it was the consensus of opinion of delegates using the units that the average refractor will last 1.5 years.

Mr. H. A. Fee of Adrian, Mich., stated that companies employing refractors in street lighting should receive a higher price for the lighting than those not using refractors. At Adrian, said he, the City Council recently closed a street lighting contract with the Citizens' Light & Power Company in which the fact is recognized that lighting with refractors is worth more than lighting without refractors.

A Legal Question in Farm-Line Practice

In the discussion on farm lines Mr. Louis B. Schneider of Tecumseh, Mich., stated that he is building farm lines in districts where farmers subscribe two-thirds of the entire cost of the line. The company accepts this cash from the farmers as a group, adds the other one-third necessary, constructs the line, and maintains it as the company's property.

Several delegates expressed the opinion that the Tecumseh company having accepted such subscriptions is bound under the law to supply energy to the farmers concerned as long as they desire it, regardless of whether the investment proves a paying venture or not. Mr. Schneider did not agree in this view of the matter.

The New Officers

Although the convention program contained many other topics for discussion the entertainment features of the trip proved so interesting that time was not available for carrying out the entire technical program.

The election of officers, which took place on the last day of the meeting, resulted as follows: President, Mr. Samuel A. Freshney of Grand Rapids; vice-president, Mr. Thomas Chandler of Sault Ste. Marie; secretary-treasurer, Mr. Herbert Silvester of Detroit; executive committee, Messrs. A. C. Marshall of Detroit, John A. Cavanaugh of Benton Harbor, A. D. Furlong of Saginaw, H. W. Courville of Jackson, and H. A. Fee of Adrian.

Miscellaneous News Notes

Central Station Benefits from War Orders.—The Delaware County Electric Company has received a "war order" from the Premos (Pa.) Chemical Company calling for 75 hp to operate pumps and blowers used in the manufacture of some of the chemicals which cannot now be imported from Europe.

Crew Sets Pole in Thirty-eight Seconds.—At the annual field day of the Boston Edison company the pole-setting contest was won by the Waltham (Mass.) linemen, who dug a hole, set a pole plumb, and back-filled the hole in 38.6 seconds. The men on the team were Messrs. R. W. Stevens, H. F. Warren, M. B. White, M. Elson and A. Carrothers. The Somerville team was second, its time being 42.4 seconds.

Asheville Company to Return Meter Deposits.—After Aug. 1 customers of the Asheville (N. C.) Power & Light Company who have been in good standing for two years will receive checks for the amount of their meter deposits plus interest from the date of deposit, provided the date is not prior to Jan. 1, 1908. Deposits still will be requested from new customers, but will be returned after two years with interest at 6 per cent.

Women's Auxiliary Safety Organization.—To aid in reducing the home accidents which are thought to affect seriously the efficiency of workmen, a women's auxiliary to the safety organization of Division J of the Central Illinois Public Service Company has been formed at Beardstown, Ill. The new organization has fifteen members and has elected the following officers: President, Mrs. William F. Gilman, Beardstown; vice-president, Miss Edna Mae Weber, Beardstown; secretary, Miss M. M. Mitchell, Havana.

Electricity to Build Cincinnati's New Courthouse.—The McCaul Company, which has the contract for the construction of the new Hamilton County courthouse at Cincinnati, Ohio, has completed plans for the exclusive use of electrical energy for the operation of the hoists, derricks, mixers and other mechanical appliances used in the construction work. The reasons given for substituting electricity for steam are its greater convenience and the elimination of the smoke nuisance. This is the first time in Cincinnati that electric drive has been used exclusively in building operations.

Houston Becomes Stone & Webster Headquarters for Texas.—The district offices of the Stone & Webster Management Association for its several electric-railway and lighting properties in the state of Texas will be moved from Dallas to Houston, where a more central location is secured with respect to the company's properties at El Paso, Beaumont, Galveston, Houston, Dallas, and Fort Worth. The change of location is to be made by Mr. L. C. Bradley, assistant district manager of the company, and his office staff, on July 10. A suite of offices in the Scanlan Building has been engaged.

Utah Municipal Plant Installs Meters. — The municipal plant at Brigham City, Utah, has passed a regulation recently requiring all customers to install meters. The plant has been operated for several years on a flat-rate basis, but it was found that the transmission and distribution lines were kept loaded by the extravagant and needless use of energy by patrons, which rendered it difficult if not impossible to give good service. The installation of meters is being done under the supervision of the city electrician, Mr. Julius Wright, and will require about two months, after which time all flat-rate service will be discontinued.

Electrical Credit Men Meet and Elect Officers.—At the sixteenth annual meeting of the National Electrical Credit Association, which was held in Pittsburgh, Pa., June 25, records of the association were read showing that during the past year 16,595 accounts aggregating $1,144,918.16 had been submitted to the five local associations. After the meeting the delegates were entertained by the local Pittsburgh association. Officers for the ensuing year were elected as follows: President, Mr. Allan R. McDonald, Stuart-Howland Company, Boston; vice-president, Mr. Robert Edwards, Jr., Edwards & Company, Inc., New York; general secretary-treasurer, Mr. Frederic P. Vose, Vose & Vose, Chicago, and assistant secretary, Mr. Walter S. Vose of Chicago.

Teaching the School Girls Illumination.—Pupils at the Flower Technical High School for girls in Chicago received during the last school term two lectures on the principles of correct illumination. It was through the co-operation of the Chicago school authorities and the local section of the Illuminating Engineering Society that this course of instruction was made possible. One of the talks, "The Production of Light," was delivered by Mr. W. A. Durgin, and the other, "Lighting in the Home," was given by Mr. J. R. Cravath.

Security League for Preparedness.—The National Security League, Inc., of New York is circulating resolutions passed by delegates to the Peace and Preparation Conference held under its auspices recently, providing that an appeal be made to the President if consistent with the public's interest to call the early attention of Congress to the pressing need of prompt and efficient action so that the resources of the country can be utilized for the proper defense of the republic. The resolution urges the league to continue the work which it has already undertaken of bringing the people to a full realization of the deplorable state of unpreparedness and of the necessity of action by Congress.

Department of Commerce Agent Returns From South America.—Mr. J. A. Massel, special agent of the Department of Commerce, has returned to New York after a visit to Argentina, Chile, Bolivia and Peru, during which he investigated the prospects for export trade in machinery and machine tools. The investigation extended incidentally to the opportunities for the extension of business of electrical manufacturers of this country. Mr. Massel is in New York for a short time and after interviewing manufacturers in this country who are interested in his investigations, he will return to South America and will visit Brazil and other countries.

Trip of Louisville Officials.—A committee composed of three department heads of the Louisville (Ky.) Gas & Electric Company has returned from a trip, and has made its report to the Employees Club of the company on its discoveries in the way of new ideas. Messrs. L. S. Streng, superintendent of the electric department; W. A. Cowherd, general storekeeper, and McKay Reed, manager of the voucher and work order department, who made the trip, went to Chicago, St. Louis, Keokuk, Minneapolis, Indianapolis, and other cities. They made an interesting report and suggested various changes. They stated that they returned with a high regard for the efficiency of the Louisville company.

Examination for Apprentice Electrical Engineer.—The United States Civil Service Commission announces an open competitive examination for apprentice electrical engineer, for men only, on Aug. 4, 1915. From the register of eligibles certification will be made to fill vacancies in this position in the Bureau of Mines, Pittsburgh, Pa., at salaries ranging from $720 to $960 a year, and vacancies as they may occur in positions requiring similar qualifications, unless it is found to be in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion. The duties of this position will be to assist in experiments with electrical machines and apparatus for the purpose of increasing the safety and efficiency of mining operations. Persons who desire to take this examination should apply for Form 1312, stating the title of the examination, to the United States Civil Service Commission, Washington, D. C.

New York's Water Pumping Service for Fire Control.—Two city pumping stations supply water to 126 miles of high-pressure fire mains in the streets of New York City south of Thirty-fourth Street, where, on account of the great number of tall buildings, high-pressure fire service is a necessity. Each station contains six centrifugal pumps, each capable of delivering 3000 gal. per minute against a pressure of 300 lb. The pumps are directly connected to 800-hp electric motors, which receive their energy over special feeders direct from the stations of the New York Edison Company. The contract with the New York Edison Company provides for a penalty of $500 per minute for each minute of interruption or delay in the supply of electrical energy after such interruption or delay has exceeded three consecutive minutes. The average time required to place the necessary number of pumps in service is less than thirty-five seconds.

Minneapolis Company Presents Fountain to Public.—When the Minneapolis General Electric Company constructed its new substation at Thirty-third Street an artesian-well shaft was sunk inside the building. The water from this well became famous in the neighborhood, and in order to accommodate the public the company erected a white tile fountain outside the substation. On a plate appears the inscription, "Presented to the Citizen of Minneapolis by the Minneapolis General Electric Company."

Offices Consolidated at Salt Lake City.—The Utah Power & Light Company has consolidated the offices of the Salt Lake Division in the new office which occupies the north half of the ground floor of the Kearns Building at 132 Main Street. Heretofore the commercial office and electric shop have been situated at 154 Main Street, and the lines and service department and other operation departments in the old office building at 133 South West Temple Street. The front part of the main floor in the new quarters is occupied by an electric shop and display room, the principal feature of which is a complete line of electric ranges of the principal range manufacturers. The main office is reached through an entrance on either side of which are large display windows. In the rear portion of the main floor are the commercial office and accounting department. This part is separated from the electric shop by a mahogany screen with bronze trimmings, behind which are the receiving tellers' cages, the information and application clerk, duplicate bill clerk, and other employees who wait on the public. The offices of the division general manager, Mr. D. C. Green, and the sales superintendent, Mr. B. W. Mendenhall, are on the front balcony. The office of Mr. William Scott, superintendent of lines and electric service, is on the rear balcony, the two being connected by an elevated platform. A room in the front basement has been fitted up as a demonstration room. The company's general offices are on the fifth floor of the Kearns Building.

Associations and Societies

Dinner-Dance of Louisville Jovians.—Invitations have been issued by the Louisville Jovians to a dinner-dance at Sennings Park on the evening of July 16.

National Electrical Contractors Association.—As already noted in these pages, the annual convention of the National Electrical Contractors Association will be held at San Francisco, Cal., July 21 to 24.

Convention of Northwest Section, N. E. L. A.—The annual meeting of the Northwestern Section of the National Electric Light Association will be held at Portland, Ore., on Sept. 8 to 11.

Electrical Supply Jobbers' Association.—The regular fall quarterly meeting of the Electrical Supply Jobbers' Association will be held at the Clifton Hotel, Niagara Falls, Ont., Sept. 14 to 16. Sept. 15 has been set aside as manufacturers' day.

Southeastern Section N. E. L. A.—The annual convention of the Southeastern Section of the National Electric Light Association will be held at the Grove Park Inn, Asheville, N. C., Sept. 22 to 24. Mr. G. H. Wygant, Tampa, Fla., is secretary.

Meeting of N. E. L. A. Commercial Section Executive Committee.—The initial meeting of the executive committee of the Commercial Section of the National Electric Light Association will be held at the headquarters in New York on July 19.

Ohio Electric Light Association at Cedar Point.—The twenty-first annual convention of the Ohio Electric Light Association, as already announced in these columns, will be held at the Breakers Hotel, Cedar Point, Ohio, July 20 to 23. Col. C. V. Hard of Wooster, Ohio, is president of the association, and Mr. D. L. Gaskill of Greenville, Ohio, is secretary.

Outing of Detroit Engineers.—The annual outing of the Detroit Engineering Society, in which the Detroit Chemists' Society and the Detroit Section of the American Institute of Electrical Engineers joined, was held at Bois Blanc Park on June 19. One of the features was a baseball game between members of the Engineering Society and the A. I. E. E.

Galveston (Tex.) Jovians to Have Electrical Booth at Cotton Carnival.—In connection with the seventh annual cotton carnival and exposition to be held at Galveston, Tex., July 22 to Aug. 1, the local Jovians will have a booth devoted to electrical apparatus and its applications. A feature of the exhibit will be a demonstration of the uses of electricity in war and in peace.

Indiana Electric Light Association.—The Indiana Electric Light Association will hold its annual meeting at the New Deming Hotel, Terre Haute, Ind., Sept. 8, 9 and 10. Mr. T. F. Grover, general manager of the Terre Haute, Indianapolis & Eastern Railway Company, Terre Haute, is president, and Mr. Thomas Donohue, manager of the General Service Company, Lafayette, Ind., is secretary.

New York Companies' Section, N. E. L. A.—The plans of the New York Companies' Section of the National Electric Light Association include the appointment of committees on advancement and welfare and research and development. The former committee will consider safety and health, educational and training subjects and the other will keep carefully in touch with all electrical developments and report at the section meetings from time to time on the progress throughout the industry.

Associated Technical Men Organized.—A charter has been issued by the State of Illinois for a new organization to be known as the Associated Technical Men. The object of this society as stated in its first bulletin, called "A Message to Technical Men," is to promote the general welfare of its members and to advance the engineering profession. Officers of the association are as follows: President, Mr. C. E. Schutt; secretary, Mr. A. E. Gibson, and treasurer, Mr. H. E. Young, all of Chicago; board of directors—Messrs. G. A. Young of La Fayette, Ind.; Henry A. Allen, W. H. Arthur, J. C. Kelsey, C. H. Shepherd and H. A. Seward, of Chicago. The general offices of the new association are at 180 North Dearborn Street, Chicago.

Convention of Carolina and Georgia Municipal-Plant Operators.—The Tri-State Water and Light Association of the Carolinas and Georgia met on June 17 at Asheville, N. C., for its annual session and elected the following officers to serve during the coming year: President, Mr. J. W. Neave of Salisbury, N. C.; vice-president for Georgia, Mr. A. A. Pasolt of Newnan, Ga.; vice-president for South Carolina, Mr. L. V. Gaffney of Gaffney, S. C.; vice-president for North Carolina, Mr. W. E. Vest of Charlotte, N. C.; secretary and treasurer, Mr. W. F. Steiglitz of Columbia, S. C.; field secretaries for North Carolina, Mr. R. I. Korner of Charlotte and Mr. J. D. Bourne of Asheville; for Georgia, Mr. James Smith of Atlanta and Mr. D. L. Coston of Commerce; for South Carolina, Mr. C. L. Korner of Columbia and Mr. E. V. Plane of Columbia. The next annual meeting will be held at the Isle of Palms.

Program for Convention of N. E. L. A. New England Section.—As stated in a previous issue, the seventh annual convention of the New England Section of the National Electric Light Association will be held at the Mount Kineo House, Moosehead Lake, Kineo, Me., Sept. 14 to 17. On the evening of Sept. 14 a reception will be held, followed by dancing and card playing. On Sept. 15, "power day," two business sessions will be held and twenty-minute papers will be presented by representatives of manufacturing companies operating isolated plants and representatives of central stations doing a large motor-service business on the following topics: "Why Central Stations Do Not Get All the Big Power Business," "Central-Station Practice in Renting Motors for Factory and Mill Installations," "Standardizing of Voltages for Mill and Factory Motor Service." In the evening there will be a formal dinner with N. E. L. A. officers, the Governor of Maine, and representatives of Public Service Commissions of the New England States as honorary guests. A Public Service Commission session will be held in the morning of Sept. 16. In the afternoon of that day there will be a paper and discussion of "Present Developments of Type C Lamps," by representatives of manufacturers and central stations. No special program has been arranged for the evening of that day. In the morning on Sept. 17 the report of the electric vehicle committee, of which Mr. E. S. Mansfield is chairman, and sub-committees will be presented. In the afternoon sports and other entertainments are planned.

Public Service Commission News

New York Commissions

Residents of Northport, Long Island, purchasers of electrical energy from the Long Island Lighting Company, have withdrawn their complaint before the Second District Commission as to rates. When the complaint was served, the company answered that it was conferring with the complainants with a view to an amicable settlement. A petition filed with the commission, signed by those who signed the original complaint, says that the complainants have obtained facts as to sales by the company in other villages. They learned that the rates charged in the various villages are the same, and that there is no discrimination, and they are also aware that the company has taken measures to reduce the cost.

A complaint filed with the First District Commission against the Edison Electric Illuminating Company of Brooklyn says that the company desires to remove a prepayment electric meter and substitute an ordinary charge meter, with the result that the bill of the consumer will be at least $1 per month. With a prepayment meter, the consumer says, his charges amount to about $10 a year. The company admits that it proposes to remove all prepayment meters, on the ground that they are mechanically deficient and unreliable. The commission ordered a hearing.

In refusing to permit the Ulster & Delaware Railroad to increase its mileage-book rate from two to three cents per mile the up-State Public Service Commission for the Second District on July 7 made what is declared to be one of the most important statements of principle since the passage of the commissions law in 1907. The majority of the commission held that, notwithstanding the broad rate-making powers granted by the Hughes statute and its amendments, the commission has not the power to permit a rate to be increased above a maximum set by the legislature. Chairman Van Santvoord in the prevailing opinion pointed out that should the commission assume the power to permit such increases, not only the mileage-book law involved in the present case but such other statutes as the three-cent maximum-fare law, and possibly the 80-cent gas law for New York City, and other similar enactments, might be in effect repealed by the commission's decisions.

Pennsylvania Commission

In declaring that it had no jurisdiction over appeals from the decisions of the commission, under the revised act of June 3, the Dauphin County Court has left nearly two score of such appeals from various business men's and improvement associations undecided with no apparent way of ever questioning the decisions in court. Under the 1913 act the Dauphin County Court was named as the tribunal to hear all appeals from the commission decisions. When this act was superseded on June 3 the appeals were directed to the Superior Court with the proviso that they must be made within thirty days of the commission's decision. About forty decisions had been filed for argument in the Dauphin County Court, and when the first of these was called the court announced that under the latest act it had no jurisdiction. As more than thirty days have elapsed since the commission's decision, there are no means of disposition of these appeals. Already several appeals have been made to the Superior Court, and at least one of these will question the constitutionality of the new act.

The commission has decided that the Philadelphia Electric Company shall complete the inventory and appraisal of its property by Aug. 2. Notice to this effect has been served upon the company by the commission, with the announcement that the hearing in the municipal light rate case will be resumed in Harrisburg on Aug. 10.

California Commission

The commission has dismissed formally the application of the Oro Electric Corporation for permission to operate under a franchise granted by the Stockton City Council. The order follows the decision of the State Supreme Court upholding the commission in its refusal to permit competition with the Western States Gas & Electric Company, which has its headquarters at Stockton.

Personal

Mr. F. W. Garry has been appointed vice-president and manager of the Post (Tex.) Power Company.

Mr. E. A. Collins has been appointed general manager of the Douglas (Wyo.) Electric Light Company.

Mr. A. O. Stahel has been appointed superintendent of the municipal water and lighting plant at Nashwauk, Minn.

Mr. Samuel J. Mott has been appointed city engineer of Saratoga Springs, N. Y. The city now has a commission form of government.

Mr. S. F. Caldwell is the new manager and general superintendent of the North Missouri Light & Power Company of New London, Mo.

Mr. F. E. Crawford is the new local manager of the Nebraska Gas & Electric Company at Wymore, Neb., succeeding Mr. L. H. Archard.

Mr. R. F. Sikes has been appointed local manager at Ennis, Tex., for the Texas Power & Light Company to succeed Mr. M. P. Ruthenberg.

Mr. W. C. Hepperle has been appointed general manager of the Hanover (Pa.) Light, Heat & Power Company to succeed Mr. Robert E. Manley.

Mr. George Holtel, Sr., has been elected president of the Oldenburg (Ind.) Electric Light, Power & Waterworks Company to succeed Mr. B. J. Kessing.

Mr. J. Y. McClure has been appointed superintendent of the Home Light & Power Company of Copperhill, Tenn., to succeed Mr. W. E. Swearenger.

Mr. Carl Oppen has been appointed manager of the Northwest Light & Power Company of Pipestone, Minn., to succeed Mr. J. W. Campbell, Jr.

Mr. J. K. Tuthill is the new local manager at Chenoa (Ill.) for the Bloomington (Ill.) & Normal Railway & Light Company, succeeding Mr. E. A. Moschel.

Mr. George F. Stoldt has been appointed superintendent of the municipal electric-light plant at Jacksonville, Ill. He succeeds Mr. W. H. Catherwood.

Mr. J. J. Connell has been elected president and superintendent of the New Berlin (N. Y.) Light & Power Company, succeeding Mr. E. G. White.

Mr. W. R. Hall, formerly manager of the Anniston, (Ala.) Electric & Gas Company, is now with the Alabama Traction Company at Decatur, Ala.

Mr. G. McClellan has been appointed local manager for the Pacific Power & Light Company at White Salmon, Wash., to succeed Mr. C. E. McNeil.

Mr. J. Emory Mathis has been appointed manager and contracting agent of the Public Utilities Company of Americus, Ga., to succeed Mr. W. M. Case.

Mr. M. F. Warner has been appointed successor to Mr. D. H. Skoon as manager of the Public Service Company of Western Kentucky, at Hickman, Ky.

Mr. Fred G. Hamilton has been appointed vice-president and manager of the Yosemite Power Company, La Grange, Cal., as successor to Mr. L. R. Waley.

Mr. P. L. Nourse has succeeded Mr. F. C. Stewart as local superintendent of the Hemet and San Jacinto divisions of the Southern Sierras Power Company.

Mr. C. D. Pollard is the new local superintendent at El Paso (Ill.) for the Bloomington & Normal Railway & Light Company, succeeding Mr. E. H. Gray.

Mr. L. B. Horne is manager of the Lehighton Electric Light & Power Company, Lehighton, Pa., having succeeded Mr. A. H. Kudlich, who died recently.

Mr. William H. Howe has been elected president of the Thousand Islands Electric Light & Power Company of Clayton, N. Y., to succeed Mr. C. A. Ellis.

Mr. J. W. Ness, formerly superintendent of the Brinkley (Ark.) Water & Light Company, has been appointed manager of the company, succeeding Mr. J. J. Farrell.

Mr. Charles Van Buren, formerly vice-president of the Schodack Light & Power Corporation of Castleton, N. Y., has been elected successor to Mr. William Morrison, the former president of the company.

Mr. Charles E. Peterson has been elected president of the Fullerton (Neb.) Electric Light & Power Company, to succeed Mr. E. L. Thomas.

Mr. L. A. Webb has been elected president of the Central Light & Manufacturing Company of Pe Ell, Wash., to succeed Mr. S. Norton Bobo.

Mr. F. N. Wilkenson has been appointed local manager at Palestine, Tex., for the Texas Power & Light Company to succeed Mr. C. A. Martin.

Mr. W. E. Gooch has been appointed local manager at Cleburne, Tex., for the Texas Power & Light Company, to succeed Mr. Thomas C. Cook.

Mr. Lyman E. Cooley, consulting engineer for the Sanitary District of Chicago, was granted the degree of doctor of engineering by the University of Michigan at its seventy-first annual commencement on June 24.

Mr. Edwin D. Wood has been appointed electrical operating engineer for the properties of the Louisville Gas & Electric Company, with headquarters at Louisville. Mr. Wood is a graduate of Depauw University.

Mr. Charles H. Rowland has been elected president and manager of the Trenton (Mo.) Gas & Electric Company, a subsidiary of the Interstate Electric Corporation of New York City, to succeed Mr. Ralph J. Irvine.

Mr. D. G. Porter is now vice-president and manager of both the People's Power Company at Moline, Ill., and of the Moline-Rock Island Manufacturing Company, an affiliated company, having succeeded Mr. F. W. Reimers.

Col. D. R. Street, who has been re-elected president of the Canadian Electrical Association, which is a geographic section of the National Electric Light Association, is the secretary-treasurer of the Ottawa Light, Heat & Power Company, Ltd., of Ottawa, Ont., which owns the Ottawa Electric Company and the Ottawa Gas Company. Colonel Street has been connected with the central-station interests of Ottawa for nearly a quarter of a century. In addition to his important business interests, the colonel takes a lively interest in the affairs of the Canadian Electrical Association and was from the first a strong advocate of its affiliation with the N. E. L. A. During fifteen years in the Governor-General's Foot Guards Colonel Street was advanced through successive promotions to the command of the regiment in 1908 and served in that capacity at the tercentenary celebrations at Quebec and at Lake Champlain. Colonel Street's unanimous re-election to the presidency of the association represents the feeling of the members that his great services for the welfare of the organization demanded all the recognition within their power.

D. R. STREET

Mr. W. J. Kyle, formerly commercial engineer with the Mississippi River Power Company at Keokuk, Iowa, has been appointed industrial engineer for the Pennsylvania Utilities Company at Easton, Pa., and will have charge of motor-service sales at Easton and vicinity.

Mr. Henry Floy, consulting engineer, New York City, has been retained by the Department of the Interior at Washington to go to California for the purpose of inspecting and reporting on the plant and property of the Mt. Whitney Power & Electric Company, which is situated within the Legnoia National Park. Mr. Floy left for California on July 1 and will be in the West several weeks.

Mr. Robert G. Pate, formerly secretary of the Electrical League of Cleveland, Ohio, has been appointed commercial superintendent of the Cleveland Telephone Company, and will take charge July 15 following the resignation of Mr. Thomas P. Cagwin, who has become secretary of the convention board of the Cleveland Chamber of Commerce. Mr. Pate has been with the Cleveland Telephone Company in various positions since 1892.

Mr. Charles H. Wilson, who for fifteen years has been general superintendent of the American Telephone and Telegraph Company, has been appointed to the newly created position of general manager of the company.

Mr. Samuel A. Freshney, president-elect of the Michigan Section of the National Electric Light Association and one of the pioneers of the electrical industry in the Middle West, was born in London, England. Coming to this country in early childhood with his parents, he was educated in the schools of Cleveland, Ohio. His first electrical work was with the Brush Electric Company of Cleveland between the years of 1884 and 1891. In 1891 he was made manager of the Muskegon (Mich.) Electric Light & Power Company and he retained that position until 1900, when he accepted a position as sales representative for the Fort Wayne (Ind.) Electric Works. After having been employed for two years as a salesman for this company, he returned to Muskegon, Mich., as general manager of the Muskegon Traction & Lighting Company. From 1905 to 1912 Mr. Freshney was secretary and general manager of the Grand Rapids (Mich.) board of public works, and at the close of this term of office he was employed for a few months by the Electric Bond & Share Company of New York City. On Sept. 1, 1912, he was made general manager of the Grand Rapids-Muskegon Power Company, which position he still occupies. Mr. Freshney is a member of the American Society of Mechanical Engineers and a life member of the National Association of Stationary Engineers.

S. A. FRESHNEY

Mr. B. F. Locke, of Ticonderoga, N. Y., has been appointed manager of the Gardner (Mass.) Electric Light Company to succeed Mr. J. Damon Whittemore, who resigned recently to go to Claremont, N. H., as already announced in these columns.

Mr. John Joseph Carty, who took office as president of the American Institute of Electrical Engineers at the time of the annual convention at Deer Park, Md., last week, is the chief engineer of the American Telephone & Telegraph Company and a leader in the field of telephone engineering. Born at Cambridge, Mass., April 14, 1861, young Carty was, as the result of difficulty with his eyesight, obliged to forego a college course and at the age of eighteen became a telephone operator in Boston. After varied work in the operating and manufacturing divisions of the telephone industry, Mr. Carty was in 1887 appointed in charge of the cable department of the Western Electric Company, with headquarters at New York City. While holding this position he invented a method of cable manufacture which reduced the cost of cable by one-half. Mr. Carty was afterward also placed in charge of the switchboard department of the company and thus supervised the installation of most of the large central-office switchboards of that period. About 1888 he arranged to supply a number of local office operators' telephones from a common source of energy, and from these early experiments has grown the present common-battery system employed in all modern city telephone systems. In 1889 he reorganized the technical department of the predecessor of the present New York Telephone Company, reconstructed the plant, and placed the metallic circuits underground. Mr. Carty has also been the

J. J. CARTY

author of a number of papers on telephony, electromagnetic induction and allied topics. As chief engineer of the "A. T. & T," Mr. Carty is responsible for standardizing the methods of construction and operation of the vast plants of that corporation, which extend to almost every community in the United States. For his work in developing the bridging bell, Mr. Carty received the Edward Longstreth medal of merit from the Franklin Institute. He has also been awarded the Japanese orders of the Rising Sun and of the Sacred Treasure by the Emperor of Japan. Mr. Carty is a fellow of the A. I. E. E., a past-president of the New York Electrical Society, and a member of the Franklin Institute, the Society of Art, and numerous engineering and telephone organizations.

Mr. Norman S. Alexander, for the last ten years connected with the Cumberland County Power & Light Company of Portland, Maine, has been appointed general manager of the Fairmount Park Transportation Company of Philadelphia.

Mr. C. E. Bennett, for the last two and one-half years electrical engineer with the Northern Contracting Company and the Georgia Railway & Power Company of Atlanta, Ga., has resigned his position in order to become associated with Mr. Hugh L. Thompson, consulting engineer, Waterbury, Conn. Before moving to Atlanta Mr. Bennett was electrical engineer with Mr. L. B. Stillwell, New York City, and later with Mr. Charles O. Lenz of New York City.

Prof. Charles M. Spofford of Fay, Spofford & Thorndike, consulting engineers, Boston, and head of the department of civil and sanitary engineering of the Massachusetts Institute of Technology, has been appointed by Governor Walsh of Massachusetts, as a member of the commission which will investigate the subject of terminal facilities in the Boston Metropolitan District. The commission will also determine the proportion of expense which should be borne by the commonwealth, by the city of Boston, and by public service corporations.

Mr. Mike S. Hart, who is well known among central-station commercial men throughout the country as manager of the commercial department of the Middle West Utilities Company, with headquarters at Chicago, has just resigned that position to go into the cotton brokerage business in New Orleans, La. In the employ of his father, who built the system of the Consumers Electric Company of New Orleans, Mr. Hart superintended the construction of the latter's plant, the work on which began in 1903. Later he was made secretary and superintendent of the company. When the property passed through a receivership Mr. Samuel Insull, receiver, appointed Mr. Hart manager of the company, which was then called the Consumers Electric Light & Power Company. In 1912 Mr. Hart went to Chicago to become general manager of the commercial department of the Middle West Utilities Company, which was then being organized. While with the Middle West company Mr. Hart was responsible for the trip of the exhibition car which carried a fully equipped electrical display to all of the company's properties. Mr. Hart was secretary of the rate research committee of the National Electric Light Association for two years. He has also been Jovian statesman for Louisiana and statesman-at-large for Illinois. Mr. Hart's new address will be 506 Hibernian Bank Building, New Orleans, La.

M. S. HART

Obituary

H. P. Hetherington, for many years a member of the Public Lighting Commission of Detroit, Mich., and for ten years managing editor of the Detroit *Journal,* died on June 29.

Corporate and Financial

Birmingham (Ala.) Railway, Power & Light Company.—The directors have decided that, in view of conditions in the company's territory, it would be good policy to defer payment of dividends due at this time on the preferred and common stocks.

Camaguey (Cuba) Electric Company, Ltd.—No decision has been made public by the Electric Bond & Share Company in regards to its option to purchase the company's property. While the Electric Bond & Share Company would neither confirm nor deny the reports it is believed generally that it is planning to take over a number of properties in Cuba. It is known that the company has been considering for some time the purchase of other properties in that region, but as yet no definite action has been taken.

Colorado Power Company, Denver, Colo.—Earnings for the twelve months ended May 31, 1915, follows:

Gross income	$813,986
Operating expenses and taxes	278,901
Net income	$535,085
Bond interest	206,365
Balance	$328,720
Depreciation (reserve)	69,572
Surplus	$259,148

Duluth (Minn.) Edison Electric Company.—Following are the earnings for the twelve months ended April 30, 1915:

Gross earnings	$510,713
Operating expenses and taxes	321,784
Net earnings	$188,929
Interest on bonds	67,650
Balance	$121,279
Dividends on preferred stock	69,000
Balance	$52,279
Bond sinking fund	25,000
Balance	$27,279

Hamilton (Ohio) Gas & Electric Company.—Mr. W. A. Everson, the receiver, has filed in the United States District Court at Cincinnati his report, showing receipts of $7,454 and disbursements of $3,438, turning over the balance to the trustee.

Iowa Electric Company, Marengo, Iowa.—An issue of $50,000 of first mortgage 6 per cent gold bonds is offered at 99 and interest to net over 6 per cent. Earnings for the year ended April 30, 1915, follow:

Gross earnings	$54,044
Operating expenses and taxes	24,016
Net earnings	$30,028
Annual interest charge on bonds outstanding	10,500
Surplus	$19,528

Lambertville (N. J.) Heat, Light & Power Company.—The decision of Vice-Chancellor Backes in the litigation involving the company, that the property be sold, has been upheld by the Court of Appeals.

Massillon (Ohio) Electric & Gas Company.—The Public Utilities Commission of Ohio has authorized the issue of $118,000 of 5 per cent first mortgage sinking-fund gold bonds at not less than 80 and $125,000 of 6 per cent cumulative preferred stock at not less than 87. The proceeds are to be used to reimburse the treasury for money expended for improvements.

New Orleans (La.) Railway & Light Company.—A block of 6 per cent debentures due on June 1, 1916, is offered at par and interest. The earnings for the twelve months ended March 31, 1915, follow:

Gross income	$7,010,750
Operating expenses and taxes	4,217,320
Net income	$2,793,430
Interest on funded debt	1,555,880
Balance	$1,237,550
Interest on debentures	240,000
Surplus	$997,550

Northern Ohio Traction & Light Company, Akron, Ohio.—An issue of $500,000 of 6 per cent secured gold bonds dated July 1, 1915, and due serially, is offered at par and interest.

Oceanside (Cal.) Electric Company.—The California Railroad Commission has issued a supplemental order authorizing the issue of $12,442 promissory notes, payable on demand.

Ohio State Power Company, Freemont, Ohio.—In the Freemont Common Pleas Court on June 26 the receivership of the Sandusky River Power Company was ended and the property was transferred to the Ohio State Power Company.

Pacific Light & Power Corporation, Los Angeles, Cal.—The California Railroad Commission has granted authority for the issue of $2,338,000 of 6 per cent collateral trust bonds, secured by $3,118,000 of first mortgage 6 per cent bonds of the Southern California Gas Company.

San Diego (Cal.) Consolidated Gas & Electric Company.—The California Railroad Commission has issued an order authorizing the company to reimburse its treasury from the $24,000 premium on the sale of common stock of the par value of $240,000. This reimbursement is for capital expenditures of $24,421 for boilers, generators, transformers, etc.

San Joaquin Light & Power Company, Fresno, Cal.—Holders of Series B 5 per cent bonds are now being offered an opportunity to exchange them for 6 per cent Series C bonds, in accordance with a ruling made recently by the California Railroad Commission. The exchange will be made upon payment of $100 for each $1,000 bond of the B series, which amounts to $2,924,000. In a letter to bondholders, Mr. W. G. Kerckhoff, president of the corporation, says: "It was only after very mature deliberation that your directors decided to issue additional 6 per cent bonds. Investment market conditions during the past few years and rates of interest paid by the country's largest railroad corporations, notably the New York Central and the Pennsylvania, on their most recent offerings of long-term bonds were final determining factors. Careful consideration was given to the question of what would be the possible effect on the market price of the present outstanding Series B 5 per cent bonds in case additional 6 per cent bonds were issued. The general feeling was that since both the Series B bonds and the Series C bonds are equally secured, the tendency would be for the two issues to sell on about the same yield basis. Your directors and the corporation's bankers endeavored to work out a plan which would place the Series B bonds as nearly as possible on the same market basis as the corporation's Series A and C bonds."

Texas Power & Light Company, Dallas, Texas.—The company has completed arrangements to acquire eight or ten small properties along the new transmission line now under construction and extending south from Waco through Temple to Taylor. At Bartlett, where the Bartlett Electric Light Company was taken over, the company was granted a fifty-year franchise. The company has also arranged to supply a number of small towns along the line now under construction from Dallas north to Denison. From this line energy will be supplied to the Texas Traction Company. While no one of the plants displaced had a large load the combined load will be appreciable. Other lines which are under consideration are from McKinney to Bonham to tie in with the line from Paris and from Sherman to Gainesville, where the company has a plant.

The Connecticut Power Company, New London, Conn.—A block of $300,000 first and consolidated mortgage 5 per cent sinking-fund gold bonds due on April 1, 1963, is offered at 95 and interest, to yield about 5.30 per cent. The proceeds will be applied toward retirement of floating debt, amounting to $405,000, incurred for extensions and improvements made necessary by increasing business. Earnings and expenses for the twelve months ended May 31, 1915, follow:

Gross earnings	$496,558
Operating expenses, taxes and rentals	271,611
Net earnings	$224,947
Interest charges	98,246
Balance	$126,701
Bond sinking fund	3,847
Balance	$122,854

Utah Light & Power Company, Salt Lake City, Utah.—Prior-lien mortgage 4 per cent gold bonds due Jan. 1, 1930, are offered at 86 and interest, to net 5.4 per cent.

Western States Gas & Electric Company, Stockton, Cal.—The California Railroad Commission has issued an order authorizing the company to issue and sell before June 30, 1916, $266,000 face value of its thirty-year 5 per cent first and refunding bonds at not less than 85 and to issue and sell $33,000 face value of its three-year 6 per cent notes, due Oct. 1, 1917, at not less than 93. The proceeds of both shall be used to pay for extensions, additions and betterments to the company's plant as follows: Stockton Division, $225,000; Richmond Division, $20,000; Eureka Division, $12,000; total, $257,000. The company estimates its construction expense during the coming year at the last-named amount. It has an authorized bond issue of $10,000,000, bearing 5 per cent interest. Of the first and refunding bonds $6,600,000 are appropriated to pay 75 per cent of the purchase price of new properties and of betterments, under certain conditions. The company has spent to April 30, 1915, $2,326,720 for these purposes, and has issued bonds for $1,671,000 face value. It has the right to issue $74,040 under its deed of trust, but needs $257,000 to finance construction expenditures for the year ending May 1, 1916. Seventy-five per cent of that estimate is $192,750, which, with the $74,040 remaining, equals $266,790. The bonds at 85 should bring $226,761, and the $33,000 face value in notes at 93 should bring $30,690, the two sums totaling $257,451. The company was also authorized to reimburse its treasury in the sum of $63,264 for authorized expenditures for construction, betterments and plant additions during the first four months of 1915. The company was authorized last October to spend $135,000 for these purposes in the last six months of 1914, to be obtained by the sale of its three-year 6 per cent notes. It actually expended but $71,736 and the balance, $63,624, has been used in the first quarter of 1915.

Manufacturing and Industrial

The Adams-Bagnall Electric Company, Cleveland, Ohio, has appointed Mr. Thomas H. Bibber Eastern sales manager in charge of its district office at 30 Church Street, New York.

The Condit Electrical Manufacturing Company, Boston, Mass., has appointed the Electrical Sales Engineers, Inc., 19 South Fifth Avenue, Chicago, Ill., as its local representative, to succeed the Thomas G. Grier Company.

Addition to Plant of Fort Wayne Electric Works.—The Fort Wayne Electric Works of Fort Wayne, Ind., will erect a four-story addition to their plant at Fort Wayne this summer, it is reported, the building to be 250 ft. by 100 ft.

American Rotary Valve Company.—Mr. George A. Arnold, who was formerly Chicago manager for the Lincoln Electric Company of Cleveland, Ohio, has been appointed general sales manager of the American Rotary Valve Company of Anderson, Ind.

The Inter-Mountain Electric Company, Salt Lake City, Utah, has purchased the stock and business of the Bertram Motor Supply Company and has added an automobile-supply department to its business. The company will move into larger quarters on Aug. 15. Mr. C. B. Hawley is president and general manager of the company.

Western Chandelier Company.—The Western Chandelier Company of Kansas City, Mo., has purchased at receiver's sale the stock of gas and electric fixtures of the Kansas City Gas & Electric Fixture Company, and will sell this equipment at the latter company's former location, 1407 Grand Avenue, Kansas City, the sale continuing over two or three weeks.

Metal Specialties Company Doubles Factory Space.—The Metal Specialty Manufacturing Company, Chicago, Ill., manufacturer of "Presto" cigar lighters, dash lamps, inspection and trouble lamps, and battery hand lamps, has recently doubled its factory and office space and equipment in order to take care of the large increase in its business since Jan. 1.

Mr. T. J. Turley, president of the T. J. Turley Company of Owensboro, Ky., has purchased an interest in the St. Mary's Machine Company of St. Mary's, Ohio, and has been elected secretary and sales manager of the company. The St. Mary's Machine Company manufactures gasoline engines, many of which are employed to drive small generating plants.

Employees Paid While on National Guard Service.—Mr. M. F. Westover, secretary of the General Electric Company, has written to the National Security League stating that it is generally understood among the employees that if they join the National Guard they are entitled to the privilege of absence without loss of salary or wages when called out by the proper authority.

Seamen's Act Referendum.—Directors of the Chamber of Commerce of the United States have ordered a referendum to secure an expression of opinion from business men of the country on the seamen's act. With discussion of the act extended to business men those who opposed its passage are renewing the claim that the legislation will nullify every effort to build up an American merchant marine.

Industrial Controller Company.—Mr. C. J. Kruse has been appointed manager of the motor-car accessories department of the Industrial Controller Company at Milwaukee, Wis. For four years Mr. Kruse was manager of the Cleveland office of the Cutler-Hammer Manufacturing Company and during the last year he has been at the general sales office of the company at Milwaukee. His connection with the Industrial Controller Company began on July 1.

Tests for Trolley Wire.—In presenting its report on specifications for copper wire before the recent meeting of the American Society for Testing Materials at Atlantic City, N. J., June 22 to 26, the committee of which Mr. J. A. Capp was chairman, pointed out the disagreement in which it found itself with the power distribution committee of the American Electric Railway Engineering Association with which it had been working. The A. E. R. E. A. committee, it was declared, held the opinion that trolley wire should have the strength of that called "hard drawn," and also insisted on including the specification of the "twist" test, although conceding that this could be safely applied only qualitatively.

The Virginia Machinery & Well Company, 1319 East Main Street, Richmond, Va., has recently become engaged in the jobbing business and will deal in supplies for hardware dealers, plumbers, machine shops, municipalities, mills, factories, and contractors. The company will also do a contracting business, drilling artesian wells, making test holes and borings, and selling and installing water and lighting systems for manufacturing plants, contractors, etc. Mr. C. F. Cole, who has been an officer of the Sydnor Pump & Well Company, is president and treasurer; Mr. C. R. Elman, vice-president and manager of the company has been an officer of the Thomas Hardware Company for a number of years.

Trade of the United States with South America Improving.—The foreign trade department of the National City Bank of New York reports that exports to the South American Continent in April of the current year were 20 per cent in excess of April of last year and the imports therefrom were 47 per cent greater than in the same month of last year. Exports increased to Argentina, Brazil, Uruguay, Colombia, Venezuela and Ecuador, while those to Bolivia, Chile and Peru show a slight decrease. The imports show an increase in the case of every country in South America, those from Argentina increasing about 50 per cent, from Brazil 27 per cent and from Uruguay 93 per cent.

Mr. H. M. Byllesby Heads New Ship Line to Russia.—Chicago capitalists headed by Mr. H. M. Byllesby, have established a new steamship service between New York and Archangel, Russia, by way of the Panama Canal, to take advantage of the increase in traffic created by the war. The first sailing will be on July 16. Mr. Byllesby became interested in the steamship business three months ago, when he and his associates bought control of the Seeberg Steamship Company of Mobile, Ala., which has been operating lines to Latin-American ports. This company has been reorganized as the Caribbean & Southern Steamship Company, Inc. The vessels used in the New York-Archangel service will be those of the Caribbean & Southern company, but there will be no interruption of the company's regular sailings between this country and Latin-American ports. The offices of the Carribbean & Southern company are in the Whitehall Building, New York.

Rapidly Increasing Sale of Farm Lighting Sets Predicted.—Mr. Charles H. Roth of Roth Brothers & Company, Chicago, in a paper read before the National Gas Engine Association in Chicago June 25, said: "After buying an automobile, one of the conveniences the farmer must have in his home and other farm buildings is electric light. I predict that sales of farm-lighting apparatus will shortly increase at a wonderful rate. It takes time to properly introduce all new things, but it may be expected that the demand for farm-lighting equipment in the near future will be enormous. To handle this vast business properly as it grows it is of vital importance that every manufacturer of gas engines, every jobber, and every dealer be thoroughly posted on the use of electricity on the farm. It is becoming easier from day to day to keep well informed on this subject as the installations are being improved and standardized."

Need for Parcels Post to South American Countries.—Mr. J. P. Stone who has recently returned from Argentina states that in spite of all that has been done by the Pan-American Union, the different chambers of commerce, and the various commissions which have been working for a betterment of trade conditions between the United States and the republics of South America there is no parcels post between these countries, nor can postal money orders be exchanged. The matter has been the source of considerable inconvenience and has frequently been commented upon by the press during the last five years or so, but no action has been taken. Now that the American government is making every effort to foster trade with South America and to improve commercial relations and business facilities, Mr. Stone declares that there is no better purpose to which the authorities could direct their energies than to arranging a direct parcels post to South America. Mr. Stone sees no reason why money orders from this country have to go to and from South America based on exchange originating in Antwerp.

Growing Demand for Electrical Goods in Marseilles District.—In a report made by Consul General A. Gaulin, stationed at Marseilles, France, it is stated that there is an important and growing demand for electrical material in the Marseilles district. According to statistics obtained from the local Chamber of Commerce, the direct imports of the leading electrical articles entered for consumption at Marseilles during the last two years include generators, conductors, carbons, lamps, etc. Much of this material was supplied by German firms or was manufactured in France by German-owned concerns or under German patents. As a consequence of the war German competition will not be possible in the market for some time, and a favorable opening is offered for American electrical products of almost every description. Until now American trade has been practically limited to dynamos, motors, carbons, fans and dental apparatus. Mr. Gaulin declares that in order to establish a permanent trade in France it will be necessary for American manufacturers to maintain a central sales agency in Paris, with sub-agencies in the leading provincial cities. An effective organization, he asserts, is indispensable.

NEW YORK METAL MARKET PRICES

	June 29 Selling Prices Bid	Asked	July 6 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	82 2 6		79 15 0	
Prime Lake	19.75	to 20.00	19.75	to 20.00
Electrolytic	19.50	to 19.75	19.50	to 19.75
Casting	18.62½	to 18.87½	18.25	to 18.50
Copper wire base	21.50	to 22.00†	21.00	to 21.50†
Lead		5.75		5.75
Nickel		50.00†		50.00†
Sheet zinc, f.o.b. smelter		27.00†		27.00†
Spelter, spot	21.50	to 22.50†	22.00	to 22.50†
Straits tin		40.12½		39.25
Aluminum, 98 to 99 per cent	30.00	to 32.00	32.00	to 33.00

*OLD METALS

Heavy copper and wire	18.25	17.87⅞
Brass, heavy	14.00	13.50
Brass, light	10.50	10.50
Lead, heavy	5.00	4.25
Zinc, scrap	13.50	17.00

*COPPER EXPORTS

Total tons to July 6 759

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Central City Power Company, of Central City, Ky., has been chartered with a capital stock of $1,000 by R. E. Vincent, C. E. Blackwell and W. C. Coffman.

The New Holland Light & Power Company of New Holland, Ill., has been incorporated with a capital stock of $4,000 by Harry Cooper, G. A. Trenkle, and James Ryan. The company proposes to supply electrical service in the village of New Holland and to residents along the route of the transmission line from Mason City.

The Mississippi Valley Railway & Power Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $4,500,000 for the purpose of constructing and operating steam and electric power motors used on all kinds of railroads, etc., and to construct railways, telephone, and telegraph lines, etc. The incorporators are: Charles B. Bishop, Clarence J. Jacobs, and Harry W. Davis, all of Wilmington, Del.

New Industrial Companies

The La Belle Company of Jersey City, N. J., has been incorporated with a capital stock of $100,000 to manufacture electro-chemical products. The incorporators are: Joseph Kreig, Anna Kreig, and Augusta Gerhardtz, all of Jersey City.

The Standard Electric Company of New Jersey of Trenton, N. J., has been incorporated by Henry W. Hartman, Walter D. Cougle and Charles E. Milum. The company is capitalized at $125,000 and purposes to deal in electrical machinery.

The Beaver Electric Lamp Company of Newark, N. J., has been incorporated by Edward Beatty of Newark, Frederick Roseter of Irvington, and Philip Dreyfuss of Rutherford. The company is capitalized at $100,000 and intends to manufacture electric lamps.

The West Engineering Company of Louisville, Ky., has been incorporated with a capital stock of $5,000 by William M. West, Leon Lewis and Irvin Marcus. The company purposes to do a general engineering business, including the installation and operation of power plants, handle fuel engineering problems, etc.

The Power Generating Company of New York, N. Y., has been granted a charter with a capital stock of $10,000 for the purpose of manufacturing and dealing in contrivances for generating power. The incorporators are C. A. Brodek, W. H. Kimmel, and F. Krause, 22 West Nineteenth Street, New York.

The Lundin Company of Queens, N. Y., has been incorporated by S. E. Miller, A. C. Holzappel, and Andreas P. Lundin, 122 Bay Thirty-fourth Street, Brooklyn. The company is capitalized at $250,000 and proposes to manufacture insulation, refrigeration, buoyancy, and other products from balsa wood.

The Ore Purchasing & Refining Company of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of dealing in minerals, by-products, merchandise, metallurgical operations, electric construction, etc. The incorporators are: E. C. Robmann, M. Mayer, and I. Hart, 53 Hamilton Terrace, New York, N. Y.

The United States Light & Heat Corporation of Niagara Falls, N. Y., has been incorporated by G. M. Walker, A. L. Fowle, 60 Broadway, and A. S. Jones, 61 Broadway, New York, N. Y. The company is capitalized at $7,000,000 and proposes to manufacture machinery for generating electricity for lamps, heaters, and motors, etc.

The American Magnet Power Company of New York, N. Y., has been incorporated by C. Wintrowd of Danville, Ill.; W. T. Libernz, T. J. Scherer, and E. R. Thomas. The company is capitalized at $200,000 and proposes to acquire by legal assignment, title, and interest in William C. Bridge's invention, "magnet" motor, deal in electrical appliances, etc.

Trade Publications

Vacuum Cleaner.—The Grinnell Washing Machine Company, Grinnell, Ia., has published a folder on its recently developed vacuum cleaner.

Multi-Call Signal Apparatus.—A folder descriptive of its multi-call signal system has been prepared by the Multi Signal Company, 7 Sherman Street, Boston, Mass.

Flashlamps.—The Usona Manufacturing Company, 1 Hudson Street, New York, has issued a booklet which contains information on a number of different types of flashlamps.

Outdoor Substations.—The Delta-Star Electric Company, Chicago, Ill., has published descriptive leaflet No. 740, which contains information on outdoor high-tension wooden-pole substations.

Switching and Protective Apparatus.—The Railway & Industrial Engineering Company, Pittsburgh, Pa., has just published an illustrated catalog on its switching and protective equipment.

Electric Appliances.—A catalog entitled "Home Book of Electricity," which contains information on various heating appliances, has been issued by the Hotpoint Electric Heating Company, Ontario, Cal.

Direct-Current Motors.—The Eck Dynamo & Motor Company, Belleville, N. J., has issued Bulletin No. 1000, which contains information on its Type D commutating-pole, constant-speed direct-current motors.

Electric Laying-Off Board.—The C. L. McBride Manufacturing Company, Toledo, Ohio, has issued an illustrated booklet which contains information on an electrically heated laying-off board for cleaning gloves.

Small Generating Plants.—The United States Light & Heating Company, Niagara Falls, N. Y., has just published the first edition of Bulletin 117 on small generating outfits equipped with the Planté battery.

Cable for Automobiles and Motor Boats.—The Standard Underground Cable Company, Pittsburgh, Pa., has published a folder which describes its ignition, lighting and starting cables for automobiles, motor boats, motor cycles, etc.

Lightning Arresters and Switchboard Panels.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 44712, entitled "Lightning Arresters for Electric Railways" and bulletin No. 47050, entitled "Standard-Unit Direct-Current Small-Plant Switchboard Panels."

Railway Electrification.—The General Electric Company, Schenectady, N. Y., is sending out reprints of an article entitled "The Electrification of the Puget Sound Lines of the Chicago, Milwaukee & St. Paul Railway," by A. H. Armstrong, which appeared in the General Electric Review of January, 1915.

Electrical Equipment.—The Western Electric Company, New York, is sending out a bulletin on "Temco" portable electric tools, a leaflet on the "Wallace" portable lamp, leaflets on the "Rite-Heat" electric iron and the "Exide" battery for electric lighting of automobiles, a folder on "Reflectolyte" and a leaflet on the "Dumore" sewing machine motor.

Electrical Apparatus.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued folder No. 4197-H on various types of electric household helps, leaflet No. 3760 on its types EC and EH switchboards, leaflet No. 3789 and leaflet No. 3790 on its type C semi-magnet and full-magnet elevator control, leaflet No. 2322-C on its type AR single-phase motors, descriptive leaflet No. 2362-C on its type CA single-phase small motors, catalog section DS930 on its electrostatic ground detectors and voltmeters; folder No. 4294-A on telephone battery charging by means of a mercury rectifier, Small Motors No. 23 on its type CA single-phase motor and starting apparatus, leaflet No. 3820 on its heavy-duty slip-ring motors, leaflet No. 3823 on its commutating-pole rotary converters and leaflet No. 3787 on its large squirrel-cage induction motors.

Construction News

New England

SORRENTO, ME.—Arrangements are being made by the town of Sorrento to install a municipal electric-light plant, to be completed about the middle of August. Contracts have been awarded for equipment for power house. W. H. Kelley of Bangor is engineer. C. Sargent is town clerk.

BROCKTON, MASS.—The Edison El. Illg. Co. of Brockton has begun work on extension of its transmission lines into Easton Centre, South Easton and Eastondale. A. F. Nelson is manager.

WESTFIELD, MASS.—The Electric Light Commissioners are contemplating replacing the underground cable in which the wires are placed for the Elm Street ligthing system.

GROTON, CONN.—The Groton Long Point Co. has decided to have street lamps erected all over the point, covering several miles of streets. The work will be done by the Electric Light Department of the borough.

HARTFORD, CONN.—A permit has been granted to the Hartford El. Lt. Co. for the erection of a substation on Vandyle Avenue, to cost about $7,000.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the trustee of public buildings, Executive Chamber, Capitol, Albany, until July 27 for alterations and additions to State House for Court of Appeals, including construction, heating, plumbing and drainage, electric work and electric elevators. Drawings and specifications may be consulted at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is State architect.

ELLISBURG, N. Y.—Application has been made by Frank E. Hamm to the Public Service Commission for permission to erect electric transmission lines in the village of Ellisburg.

NEW YORK, N. Y.—The Board of Estimate has authorized the issue of $879,588 of corporate stock for the construction of a new fire-alarm system in the borough of Manhattan. Robert Adamson is fire commissioner.

HARRISBURG, PA.—Plans are being considered by City Commissioner Harry F. Bowman, superintendent of public safety, for changing the street-lighting system. It is proposed to replace the overhead arc lamps now in use with the single standard system. The Harrisburg Lt. & Pwr. Co. has been asked to submit an estimate of the number of single standards required.

HARRISBURG, PA.—Bids will be received at the office of the board of commissioners of public grounds and buildings, Commonwealth of Pennsylvania until July 15 for furnishing material and labor necessary for completion of a new main building (the first floor and basement having been constructed under a former contract) on the State Arsenal Grounds at Eighteenth and Herr Streets, Harrisburg. Separate proposals will be received for heating and elevators. Specifications and drawings may be obtained upon application to Samuel B. Rambo, superintendent of public grounds and buildings, Capitol Building, Harrisburg.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington D. C., until July 29 for furnishing engine and generator for the Bureau of Mines Building, Pittsburgh. For further information address the above office.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 30 for furnishing one steam engine for the Experimental Station, United States Bureau of Mines, Pittsburgh, in accordance with specifications, copies of which may be obtained at the above office.

SNOW SHOE, PA.—The Public Service Commission has approved the charter of the Snow Shoe Lt., Ht. & Pwr. Co., of Center County.

WILLIAMSPORT, PA.—Bids will be received by Samuel Stabler, superintendent of public affairs of the city of Williamsport, City Hall, Williamsport, until July 19 for lighting the streets, alleys, parks and public places of the city for a period of three, five and ten years. For details see proposal pages.

BALTIMORE, MD.—Bids will be received by the Board of Awards of Baltimore City at the office of the city register, City Hall, Baltimore, until July 14 (extension of date) for furnishing and erecting a 20,000,000-gal. centrifugal pump and electric power equipment for the Eastern pumping station, Water Department, including three 250-kva. transformers, circuit-breakers and high-tension switchboard, one two-panel low-tension switchboard, all wiring and starter for connecting up an 800-hp. motor; furnishing one 800-hp. motor and starter and one 20,000,000-gal. centrifugal pump (daily capacity). Plans and specifications can be obtained at the office of the water engineer, City Hall, Baltimore.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 20 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 8546—For 350 4-gal. cast-steel oval boilers; Schedule 8532—eight 36-in. searchlights; Schedule 8534—miscellaneous signal-warning systems, etc. Portsmouth, N. H., Schedule 8544—For 1200 lb. medium round-bar copper. East, Schedule 8537—miscellaneous hard and soft plain-sheet copper. Charleston, S. C., Schedule 8543—5600 lb. ribbed steel floor plates. Bids will also be received until Aug. 10 as follows: Mare Island, Cal., or f.o.b., Schedule 8540—15 pumps (main feed, fire, bilge, etc.) and one auxiliary condenser; Schedule 8539—one refrigerating plant. Application for proposals should give the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 17,357—An American consular officer in France reports that a number of civil engineers in his district desire to communicate with American manufacturers and exporters of electric motors and all accessories for electric installations. No. 17,358—An American consular officer in Japan reports that the management of a hotel in his district contemplates the erection of a mechanical laundry (capacity of 1000 articles per day). He desires to receive catalogs, price lists and full information relative to prices of machinery, etc. Electrically driven machinery is preferred. No. 17,367—A firm in New York writes this bureau that an industrial company in Spain desires catalogs, with technical description and prices f.o.b. steamer, New York, on general supplies for mines, such as steel shovels, coke forks, steel wire rope, etc., all kinds of wrenches, drills and tools, etc., steam boilers and engines and machinery. No. 17,326—A firm in Paris advises an American consular officer that it desires to communicate with American manufacturers of telephones and telephone equipment. Samples of wire, catalogs and prices should be sent immediately. Correspondence may be English. No. 17,412—An American consular officer in Italy transmits a detailed report relative to an opportunity for the sale of carbons and electric lamps. No. 17,418—This bureau is in receipt of a letter from a business man in India, stating that he desires to communicate with American manufacturers and exporters of electrical accessories, chemicals, to be used in dyeing and coloring. He is also interested in hardware, machinery and railway supplies. Further information may be obtained at the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

North Central

COLDWATER, MICH.—Bids will be received by the Board of Control of the Michigan State Public School at the office of J. B. Montgomery, superintendent, Coldwater, until July 14 for construction of a brick building for dependent crippled children, according to plans and specifications prepared by Edwyn A. Bowd, architect, Lansing. Bids will be received upon general work, plumbing, heating and electric wiring. Plans and specifications may be seen at the office of the superintendent at Coldwater, or may be obtained from the architect upon deposit of $10.

DETROIT, MICH.—The contract for the installation of conduits, manholes and lamp-post foundations for the proposed new lamps is reported to have been awarded to W. F. Cummings, 330 South Paulina Street, Chicago, Ill., at $100,868.

SAGINAW, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 9 for a conduit and wiring system, lighting fixtures, etc., at the United States Post Office at Saginaw. For details see proposal columns.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until July 16 for service switches for the Municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street.

HAMILTON, OHIO.—The Mosler Safe Co. of Hamilton has been granted a permit to build an addition to its power plant, to cost about $2,200.

MIDDLETOWN, OHIO.—The City Council has approved the 10-year contract with the Middletown Gas & El. Co. for lighting the streets of the city, under the terms of which the company is to install a new street-lighting system. The contract will go into effect Oct. 1, 1915.

LOUISVILLE, KY.—Bids for the electrical equipment in the new Young Women's Christian Association Building, it is reported, will soon be asked for. This work is not included in the general contract. John Bacon Hutchings is architect.

PADUCAH, KY.—The remainder of the Illinois Central Railroad system in Kentucky, it is announced, will be equipped with automatic, electrically operated block signals.

FORT WAYNE, IND.—The contract for the complete installation of an ornamental lighting system on Hoagland Avenue has been awarded to the Edmunds El. Co. of Fort Wayne.

GREENCASTLE, IND.—Bids will be received by the board of trustees of the Indiana State Farm, Greencastle, Ind., R. F. D. No. 7, until July 21 for machinery and equipment for power plant as follows: For one 16-in. by 30-in. heavy-duty Corliss engine directly connected to one 150-kw. generator; one 12-in. by 14-in. automatic, inclosed-type engine and one 60-kw. generator, directly connected; one combined generator and exciter panel for Corliss engine outfit; one combined generator and exciter panel for 60-kw. unit; one belted-type exciter for 150-kw. generator; one belted-type exciter for 60-kw. generator; one four-panel switchboard, two centrifugal pumps, two motors for driving pumps, two "Cutler-Hammer" starters, No. 9632, for control of pump and motor; two 250-hp. water-tube boilers, one feed-water heater, one breeching and two boiler-feed pumps. Specifications may be obtained upon application to C. E. Talkington, superintendent Indiana State Farm.

HAGERSTOWN, IND.—The Liberty Lt. & Pwr. Co. of Richmond, Ind., is negotiating with the City Council for a contract to supply electricity in Hagerstown. The company proposes to take over the municipal electric-light system and furnish a 24-hr. service. Negotiations are also under way between the Liberty company and the Teetor-Hartley Motor Co. whereby the former may furnish energy to operate the plant of the motor company.

NORTH VERNON, IND.—The City Council is contemplating remodeling the municipal electric-light plant and installing an additional engine and generator, at a cost of about $15,000. Through error this was published under Mount Vernon, Ind., in the issue of July 3.

GALESBURG, ILL.—Bids will be received by the Sixth Infantry Armory Commission at the office of James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago, until July 15 for the erection of armory for the Sixth Infantry, Illinois National Guard, at Galesburg. Separate bids will be received for general plumbing, heating and electric wiring. Plans and specifications may be obtained upon application to the state architect.

LEWISTOWN, ILL.—The City Council has entered into a contract with the Lewistown El. Lt. Co. under the terms of which the number of street lamps is to be increased from 40 to 89.

QUINCY, ILL.—Bids will be received by the Board of Supervisors of the Fabius River Drainage District, at the office of John H. Best, Illinois State Bank of Quincy, until July 21 for a steam-driven pumping plant, consisting of two 42-in. centrifugal pumps (capacity 46,000 gal. per min., against a head of 15 ft.). Alternate bids will be received at the same time and place on an oil-engine-driven plant and on an electrically-operated plant of the same type and capacity. For further information address the Harman Engineering Co., Peoria, Ill.

SPRINGFIELD, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, until July 26 for the construction of two new power houses as follows: one at the Elgin State Hospital, Elgin, and the other at the Chicago State Hospital, Dunning. Separate bids to be submitted for each power house. Plans and specifications may be obtained at the office of James B. Dibelka, State Architect, 130 North Fifth Avenue, Chicago.

STEVENS POINT, WIS.—Bids will be received by the Board of Regents of Normal Schools of Wisconsin, at the office of

Van Ryn & DeGelleke, architects, 726 Caswell Block, Milwaukee, until July 31 for furnishing material and constructing a three-story and basement dormitory building for the State Normal School at Stevens Point, including general work, concrete and excavating work, plumbing and sewerage work, steam heating, tile and marble work and electrical work. Plans and specifications are on file at the office of the Board of Regents, Madison, at the office of the architects and at the office of the Norman School, Stevens Point.

CLOQUET, MINN.—All bids submitted for the fire-alarm and signal system for the new fire hall have been rejected by the Council. New bids will probably be asked. The cost of the system is estimated at about $5,000.

HEIBERG, MINN.—J. F. Heiberg, owner of the local electric-light plant, expects to purchase a mechanical water-wheel governor for a 26-in. Samson water wheel, operating under a 14-ft. head.

LAKEFIELD, MINN.—Bids will be received by the village recorder, Lakefield, until July 28 for construction of additions and improvements to the waterworks system and electric-light plant as follows: (1) Waterworks, including one motor-driven deep-well pump and one motor-driven centrifugal pump; (2) electric station equipment, consisting of furnishing and erecting additions to building, one 125-hp. fire tube boiler, breeching, 4 ft. by 100 ft., concrete chimney, piping connections, etc., one 75-kva. engine-driven generator unit, switchboard, etc.; item 2—(alternative) consisting of additions to building, one 160-hp. Deisel oil engine, directly connected to one 100-kva. alternator, including complete auxiliaries, one 75-kva. alternator for present engine and switchboard, etc.; (3) pole line, consisting of furnishing and erecting poles, wire, street lamps, transformers, etc., for the electrical distribution of the village of Lakefield. Bids will only be received on complete items or complete parts. Plans and specifications are on file in the office of the village recorder, Lakefield, and also in the office of Earl D. Jackson, Capital Bank Building, St. Paul.

LYLE, MINN.—The town of Lyle expects to purchase within the next three months two oil engines, meters, transformers and rectifiers for the municipal electric-light plant; also within the next five months to purchase electrical cooking apparatus and wiring supplies. N. T. Fortun is manager.

MILACA, MINN.—Bids will be received by W. A. Erickson, recorder, Milaca, until July 20 for alterations and additions to the municipal electric-light plant in accordance with plans and specifications prepared by the Charles Pillsbury Co., engineer, Metropolitan Life Building, Minneapolis. The work includes dismantling and removal of present boilers and auxiliary equipment and the installation of new boilers of larger size and certain new auxiliary equipment. Copies of plans and specifications may be seen at the office of the recorder, and the Builders' Exchanges, Minneapolis and St. Paul, and at the office of the engineer.

MILACA, MINN.—Bids will be received by Dr. H. P. Bacon, secretary of Independent School District No. 13, Milaca, until July 20 for the entire mechanical equipment consisting of power plant, heating and ventilating system, plumbing system, electrical construction and underground conduit system, in accordance with plans and specifications prepared by Kirby T. Snyder, architect, Minneapolis, and the Charles T. Pillsbury Co., consulting engineer, Metropolitan Life Building, Minneapolis, copies of which may be obtained at the office of the secretary, Milaca; at the Builders' Exchanges Minneapolis and St. Paul, and at the offices of the architect and engineer.

NEW PRAGUE, MINN.—The Municipal Electric Light and Water Works Department expects to purchase within the next three months one 60-kw., 250-volt, two-wire direct-current generating unit, consisting of a 90-hp. four-valve, non-releasing Corliss engine and generator; also switchboard and steam fittings. Joseph T. Rynda is superintendent.

REDWOOD FALLS, MINN.—Within the next three months the Redwood Falls Lt. & Pwr. Co. expects to install one 300-kw. steam or oil engine (directly connected).

WARREN, MINN.—Bids will be received by G. O. Gross, city recorder, until July 22 for construction of additions and improvements to the municipal electric-light plant as follows: For furnishing and erecting brick addition to building, piping connections, etc., one 150-kw. direct-current engine-driven generator unit, switchboard, etc. Alternate bids will be received on alternating-current apparatus as specified. Plans and specifications are on file in the office of the city recorder, and also in the office of Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul.

FLOYD, IOWA.—The Cedar Valley El. Co. of Charles City is reported to be planning the construction of a dam across the Cedar River near Floyd and the erection of a hydroelectric plant to supply energy to operate the system of the Charles City & Western Ry. Co. and for lighting purposes in Charles City, Clarksville, Hampton and other towns.

FREDERICKSBURG, IOWA.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

RIVERTON, IOWA.—A special election will be held July 12 to submit to the voters the proposal to enter into a contract with the Hamburg El. Lt. Co. of Hamburg to supply electricity in Riverton.

SAC CITY, IOWA—Within the next three months the Sac City El. Co. expects to extend its transmission line to Wall Lake, a distance of 4½ miles; also to purchase equipment for complete distribution system of town of Wall Lake, including lightning arresters, transformers, switching apparatus, meters, etc. H. W. Deininger is manager and engineer.

STATE CENTER, IOWA.—Within the next two months the electric light committee expects to purchase one 15-kw. transformer, and 35 hp. in motors (various sizes), three-phase, 220 volts, 60 cycles, for the farmers creamery. Frank Gue, Jr., is superintendent.

WALL LAKE, IOWA.—The town of Wall Lake will vote on a bond issue to install an electric-light plant. Electricity to operate the system will be supplied by the Sac City El. Co. of Sac City, which will extend its 13,200-volt transmission line from Lake View to Wall Lake. H. W. Deininger is general manager of the Sac City El. Co.

MARYVILLE, MO.—The Maryville El. Lt. & Pwr. Co. has not yet closed a contract with the town of Conception Junction, but should an agreement be reached, the company will erect 16 miles of transmission line, wire the town and install a street-lighting system there. The company is also negotiating with the town of Pickering 8 miles north of Maryville, to furnish electrical service there. C. C. Hellmers is secretary and manager.

SEDALIA, MO.—Within the next three months the City Lt. & Trac. Co. of Sedalia, expects to purchase one 200-kw., two-phase rotary converter; also to rebuild its distribution system. Harry D. Frueauff is treasurer and general manager.

SPRINGFIELD, MO.—The board of regents of the State Normal School is considering the installation of a new power plant for the State Normal School. The Springfield Gas & El. Co. is reported to be negotiating with the board to supply the service.

SPRINGFIELD, MO.—The City Council has granted the Springfield Gas & El. Co. permission to erect a transmission line to the Fulbright pumping station of the Springfield Wtr. Co., which is to use electrical energy. The line will also supply other patrons along the line.

DAKOTA, NEB.—H. J. Ryan, engineer, of Sioux City, Iowa, has been engaged to take charge of the engineering work of the proposed municipal electric-lighting plant. Contract for the construction of plant, it is understood, has been awarded to the Johnson El. Co., 1207 Harney Street, Omaha.

FULLERTON, NEB.—Bonds to the amount of $28,000 have been voted for the installation of a municipal electric-lighting plant.

NETAWAKA, KAN.—At an election to be held July 12 the proposal to issue $10,000 in bonds for the installation of an electric-lighting system will be submitted to the voters. The erection of a transmission line from Holton is under consideration.

Southern States

CHARLOTTE, N. C.—Specifications, it is reported, will soon be issued by the Thread Mills Co. of Charlotte, for the construction of an addition to its works, including a 3000-hp. electric power plant, a 400 to 600-box loom fine art mill, and a bleachery in Charlotte, and also a 1000-loom wide-sheeting mill at Draper, at a cost of about $500,000.

TENNILE, GA.—The City Council has engaged Crook & Lanneau of Macon, consulting engineers, to prepare plans for the installation of a municipal electric-light plant, water-works and sewer systems, for which surveys are now being made.

LAKELAND, FLA.—Plans, it is reported, are being considered by C. J. Brasselle of Lakeland for the installation of an electric-light plant.

CHATTANOOGA, TENN.—Placing all electric wires on Market Street, between Ninth and Main Streets, underground is under consideration by the City Commissioners.

JELLICO, TENN.—Plans are being prepared for the installation of an ornamental street-lighting system (five-lamp clusters) in the business section of the town.

WATERTOWN, TENN.—The People's Pwr. Co. of Watertown is installing an electric-light plant in Watertown. The equipment will consist of two boilers, one of 150 hp. and the other of 80. hp.; two engines, two alternating-current generators, switchboard with regulator and transformers (pole type). About 60 lamps of 100 cp. will be required for street lighting. A. F. Trimble of Watertown is manager.

SYLACAUGA, ALA.—The city of Sylacauga, it is reported, is planning to build a concrete dam, about 18 miles from Sylacauga, to develop about 200 hp. for transmission by electricity. F. H. Poke of Sylacauga is engineer.

CLARKSDALE, MISS.—Bonds to the amount of $150,000 have been voted for extensions and improvements to the municipal electric-light plant and water-works system.

GRENADA, MISS.—The Light and Water Department of the city of Grenada expects to erect a regulating station for series street-lighting system and to do considerable overhauling of line work within the next twelve months and also to purchase arresters for unit protection; also within the next six months to purchase pumping machinery for delivery direct into mains from deep wells. S. J. Alward is superintendent.

KOSCIUSKO, MISS.—At an election held recently bonds to the amount of $30,000 were voted for the installation of a municipal electric-light plant and water-works system. C. O. Townsend is city clerk.

BIXBY, OKLA.—The City Council has adopted a resolution calling an election to submit to the voters the proposal to issue $4,000 in bonds for the installation of an electric-lighting system and $26,000 for a water-works system.

BOSWELL, OKLA.—The town of Boswell has voted to issue $14,000 in bonds for the installation of a municipal electric-lighting plant, which will be built and operated in connection with the waterworks system now under construction. Bids for electrical equipment will be advertised for in about sixty days. James T. George of Ada, is engineer in charge.

JONES, OKLA.—The Board of Trustees has engaged the Benham Engineering Co., Colcord Building, Oklahoma City, to prepare plans and estimates for a municipal electric-light plant and water-works system.

KENEFIC, OKLA.—The City Council is reported to be considering a proposal asking for a franchise to install and operate an electric-lighting plant in Kenefic.

BROWNWOOD, TEX.—The elevator and mill of the Brownwood Mill & Elevator Co., which has been leased by H. H. Sigman & Co. will be equipped for electrical operation.

DALLAS, TEX.—The Dallas Union Terminal Co. has decided to install its own plant in connection with the new union depot, to provide heat, light and power for the building. The cost of the proposed plant is estimated at about $60,000. Contracts for equipment, it is understood, will soon be placed. C. H. Dana is chief engineer.

LA PORTE, TEX.—The La Porte Wtr., Pwr. & Lt. Co. is extending its lighting system to Morgan's Point through Bay Ridge.

OLNEY, TEX.—The Olney El. Lt. & Pwr. Co., it is reported, is contemplating the installation of an electric-light plant.

Pacific States

TACOMA, WASH.—The City Council has passed resolution of intention, creating local improvement district No. 5507, in which a modern street-lighting system will be installed.

TACOMA, WASH.—The Tacoma Smelting & Refining Co., of Tacoma, it is reported, is contemplating extensive improvements at its plant, including the construction of new power house, an additional fine copper furnace and new machinery for various parts of the plant. Present plans, it is understood also provide for some electrical machinery.

BLACKFOOT, IDAHO.—The City Council is reported to be considering the investigation of several available water-power sites with a view of establishing a municipal electric-light plant.

BOISE, IDAHO.—The Utah Construction Co., owners of the Big Lost River Irriga-

tion project, it is reported, has decided to replace the Mackay dam with a new dam.

COEUR D'ALENE, IDAHO.—The City Council has authorized the light committee to petition the Public Utilities Commission for permission to construct and operate a municipal electric-light plant.

ANACONDA, MONT.—The City Council has adopted a resolution providing for the improvement of Improvement Districts 64 and 65, in which a modern lighting system will be installed. Bids for materials and installation (it is understood) will soon be asked.

GLASGOW, MONT.—Within the next six months the Electric Light Commission expects to build an addition to power house of the municipal electric-light plant and to erect more transmission lines; also to purchase a 225-hp. oil engine and a 160-kw. generator. E. S. Severance is city engineer.

WISDOM, MONT.—The Council is contemplating the installation of a municipal electric-light plant to supply electricity for the city buildings and streets, to cost about $5,000.

Canada

OKOTOKS, ALTA.—The Northwestern Engineering & Supply Co. of Calgary has been granted a franchise to install an electric-lighting plant in Okotoks. The proposed plant will be driven by a gas engine.

MISSION CITY, B. C.—Application will soon be made to the Council by Alexander Stevens and others for the creation of a rural street-lighting system in this city.

PENTICTON, B. C.—Improvements and extensions, it is reported, are contemplated to the electric-lighting system, to cost about $6,000.

WINNIPEG, MAN.—Tenders will be received by the City Light and Power Department until July 16 for a supply of electrodes, glassware and arc-lamp cut-outs for the City Lighting Department, delivered f.o.b. May Street substation. Specifications may be obtained at the above office.

AILSA CRAIG, ONT.—The ratepayers have voted in favor of the by-law authorizing the Council to enter into a contract with the Ontario Hydro-Electric Power Commission for electrical service. The cost of the system is estimated at about $7,000.

WESTMOUNT, QUE. — The Municipal Electric Light Department is contemplating placing wires in all underground conduits.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 29, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,144,350. ELECTRIC WELDING; E. F. Collins, Schenectady, N. Y. App. filed Feb. 19, 1913. Securing end ring to conductor bars of rotor.

1,144,351. DYNAMO ELECTRIC MACHINE; E. F. Collins, Schenectady, N. Y. App. filed Feb. 19, 1913. Has slotted end rings for conductor bars.

1,144,354. STORAGE BATTERY CHARGING SYSTEM; F. E. Fanning, Woodland, Ill. App. filed May 23, 1913. Three-pole switch construction.

1,144,383. MAGNETIC SEPARATING APPARATUS; E. H. Rothert, Leavenworth, Wash. App. filed Feb. 1, 1913. Two consecutive separating operations.

1,144,388. MOTOR CONTROLLER AND INDICATOR; F. W. Smith, Westfield, N. J. App. filed Oct. 24, 1913. Indicators show which resistances are in use.

1,144,390. ELECTRIC WELDING AND FUSION DEPOSITION OF METALS; A. P. Strohmenger, Westminster, London, England. App. filed Dec. 23, 1914. Electrode having metallic core and covering of wire of different metal.

1,144,391. TRANSMITTER FOR TELEPHONE AND OTHER SOUND TRANSMITTING INSTRUMENTS; W. P. Stunz, Lansdowne, Md. App. filed Dec. 31, 1910. Diaphragm common to several carbon chambers.

1,144,396. STARTER FOR VAPOR ELECTRIC DEVICES; P. H. Thomas, East Orange, N. J. App. filed April 25, 1904. Special proportioning of the filament resistance to that of the vapor.

1,144,399. RECTIFYING DETECTOR FOR WIRELESS SYSTEMS; E. T. Turney, New York, N. Y. App. filed Aug. 22, 1914. Material sensitive to alternating current and adapted to rectify same, and a finely divided conductor.

1,144,401. MAGNETO CORD CIRCUIT WITH SECRET SERVICE; R. I. Utter & H. P. Schmidt, Chicago, Ill. App. filed July 26, 1913. Special cord circuits and answering and calling plugs.

1,144,407. TELEPHONE SYSTEMS; A. H. Dyson, Chicago, Ill. App. filed Nov. 7, 1906. Automatic, with "busy" signal. (Thirty-eight claims.)

1,144,419. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed Feb. 28, 1914. Push-button snap switch.

1,144,427. GAS-CONTROL VALVE AND IGNITER; C. J. Muehlmann, Detroit, Mich. App. filed July 24, 1914. For selectively controlling different gas lamps.

1,144,431. MOTOR CONTROLLER; G. R. Radley, Milwaukee, Wis. App. filed Jan. 25, 1913. For electric automobiles.

1,144,438. ELECTRIC STARTER FOR AUTOMOBILE ENGINES; A. W. Smith, Washington, D. C. App. filed June 26, 1914. Magnet poles on starting motor draw the armature toward the fly-wheel, engaging the driving pinion with the fly-wheel rim.

1,144,465. RAILWAY TRAFFIC CONTROLING SYSTEM; A. V. T. Day, New Rochelle, N. Y. App. filed June 15, 1908. Normal danger plan of block signaling.

1,144,479. SAFETY DEVICE FOR ELEVATORS; J. A. Keyes, New York, N. Y. App. filed Aug. 19, 1912. Car cannot be started when door is open, except in emergency.

1,144,491. MECHANISM FOR INSURING UNDERSTANDING OF SIGNALS FROM BRIDGE TO ENGINE ROOM; W. Michael, Oakland, Cal. App. filed June 12, 1912. Locks reverse lever of engine in position, operative only as signal.

1,144,509. RAILWAY SIGNALING; J. D. Taylor, deceased, Wilkinsburg, Pa. App. filed Nov. 18, 1913. For single track.

1,144,517. JUNCTION BOX; P. J. Wittenberg, Chicago, Ill. App. filed Sept. 15, 1911. Has detachable bottom.

1,144,538. ELECTROLYTIC APPARATUS; W. E. Greenawalt, Denver, Col. App. filed Jan. 11, 1912. Higher anode and cathode efficiencies.

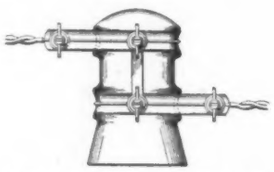
1,144,560. INDICATING SYSTEM; E. C. Momlina. East Orange, N. J. App. filed Sept. 17, 1913. For telephones.

1,144,595. PROCESS FOR MANUFACTURING INCANDESCENT FILAMENTS; R. H. Henderson, East Orange, N. J. App. filed March 25, 1910. Continuous production of filament.

1,144,596. METHOD OF AND APPARATUS FOR TRANSLATING ELECTRICAL VARIATIONS; P. C. Hewitt, New York, N. Y. App. filed March 30, 1907. Auxiliary electrodes in operative relation to a gas or vapor-carrying current. (Ninety-three claims.)

1,144,604. VOLTAGE REGULATOR; E. Lehr, Wilkinsburg, Pa. App. filed July 19, 1913. Step type for transmission lines.

1,144,605. ANNUNCIATOR; O. M. Leich, Genoa, Ill. App. filed Aug. 18, 1913. Operates drop shutter and gives code signals.



1,144,672.—Fused Test Clamp Insulator

1,144,614. ELECTRIC SAD IRON; E. E. Rose. Swissvale, Pa. App. filed Dec. 26, 1913. Simplified construction.

1,144,620. OVERHEAD LINE CONSTRUCTION; N. W. Storer. Pittsburgh, Pa. App. filed Sept. 10, 1909. For tunnels, etc.

1,144,628. BATTERY PLATES; A. S. Atwater and D. F. Selzer, Cleveland, Ohio. App. filed Jan. 2, 1914. Porous plate with no blind pockets for gas.

1,144,636. ELECTRICAL MEASURING INSTRUMENT; P. A. Campbell. Newark, N. J. App. filed Jan. 3, 1910. For incandescent lamp filaments.

1,144,648 ELECTRIC APPARATUS; C. Le G. Fortescue, Wilkinsburg, Pa. App. filed July 6, 1908. Insulating bushings for transformer leads.

1,144,656. FLASHLIGHT ATTACHMENT FOR GUNS; J. P. Hise & W. H. Moyers, Hightown, Va. App. filed June 18, 1914. Pivoted so that light rays can be directed at angle to gun barrel.

1,144,672. FUSED TEST CLAMP INSULATOR; G. Wheale, Meadowbrook. Pa. App. filed Jan. 27, 1914. Readily renewable fuse.

1,144,673. ADVERTISING DEVICE; W. B. Wheeler, Long Beach, Cal. App. filed Jan. 5, 1914. Intermittently movable sign.

1,144,680. ELECTROPLATING APPARATUS; H. G. Allers, Buffalo, N. Y. App. filed May 23, 1914. For articles which have been repaired with solder.

1,144,732. FUSE DEVICE; E. O. Schweitzer and A. Herz, Chicago, Ill. App. filed April 3, 1907. Arc interrupting construction.

1,144,745. RELAY; S. E. Witt, Chicago, Ill. App. filed Oct. 7, 1912. Improved mounting of relay armature.

1,144,748. HOROLOGICAL MOTOR; B. A. Adler, Chicago, Ill. App. filed June 23, 1913. For secondary clock—has periodical correcting mechanism.

1,144,781. PLUG SWITCH; F. J. Ravlin and J. Lofgren, Chicago, Ill. App. filed Dec. 3, 1914. Multiple circuit construction.

1,144,801. ELECTRIC HEATER; B. Van Steenbergh, Goshen, N. Y. App. filed July 2, 1914. For generating carburreted hydrogen from hydro-carbon oil.

1,144,915. MAGNETO FOR USE ON INTERNAL COMBUSTION ENGINES; J. A. Cole, Leamington, Eng. App. filed July 28, 1914. By fully retarding the contact breaker, the current is short circuited and engine stopped thereby.

1,144,943. ANNUNCIATOR; L. C. Hodson, Winnipeg, Manitoba, Canada. App. filed Aug. 23, 1911. Operates a hand over a dial.

1,144,870. CODE SIGNAL DEVICE; A. L. Sohm, Chicago, Ill. App. filed Aug. 23, 1913. For calling particular persons in factories, etc.

1,144,871. WEATHERPROOF ANNUNCIATOR CASE; A. and P. K. Stern, Yonkers and New York, N. Y. App. filed Feb. 25, 1913. Automobile direction signal.

1,144,872. CONTROLLER; A. Stern, Yonkers, N. Y. App. filed March 21, 1914. Make and break circuit type.

1,144,873. SIGNALING SYSTEM; A. & P. K. Stern, Yonkers and New York, N. Y. App. filed April 22, 1914. Vehicle direction indicator.

1,144,876. STARTING BOX; M. Taigman, New York, N. Y. App. filed April 9, 1914. Parts put in circuit by placing them in the box.

1,144,885. ELECTRIC CLOCK SYSTEM; L. J. Aron, London, England. App. filed Sept. 30, 1912. A master clock in each main circuit.

1,144,898. FAULTFINDER FOR INTERNAL-COMBUSTION ENGINES; D. P. F. Ghadiali, New York, N. Y. App. filed Oct. 30, 1912. Sparking tubes and globe tubes separately assembled in paired relation to show faults in ignition.

1,144,935. MACHINE-TOOL CONTROL; A. L. DeLeeuw, Cincinnati, Ohio. App. filed Feb. 19, 1913. Electro-mechanical system for milling machines, etc.

1,144,941. MICROSCOPE WARM STAGE; T. Lidberg, Chicago, Ill. App. filed June 24, 1914. For maintaining specimens at predetermined constant temperature.

1,144,942. INCUBATOR FOR MICROSCOPE STAGES; T. Lidberg, Chicago, Ill. App. filed June 24, 1914. Process or reproduction can be conveniently observed.

1,144,948. METAL ARMOR CIRCUIT CONNECTING ATTACHMENT; J. C. Stearns, Worcester, Mass. App. filed Dec. 16, 1912. Permanent durable plug construction.

1,144,949. ELECTRICAL FITTING; J. C. Stearns, Worcester, Mass. App. filed March 18, 1914. Automobile tail lamp.

1,144,954. ELECTRIC HOT-WATER HEATING SYSTEM; W. L. Waters, Milwaukee, Wis. App. filed Jan. 22, 1913. Utilizes waste heat from electric stove.

1,144,969. RADIO TELEGRAPHY AND TELEPHONY RECEIVER; G. W. Pickard, Amesbury, Mass. App. filed April 17, 1914. Oscillating currents of two different frequencies.

1,144,973. ELECTRIC APPARATUS FOR DRIVING CLOCKS OR SIMILAR MECHANISM; H. E. Warren, Ashland, Mass. App. filed July 27, 1910. Contact made by mercury in exhausted container.

1,144,981. ELECTRIC HEATER; E. N. Lightfoot, New York, N. Y. App. filed Nov. 18, 1911. Circuit controlled by insertion of curling iron.